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Chicago, October 16, 1926 (*Issued Every Other Week*) Volume XXIX No. 21

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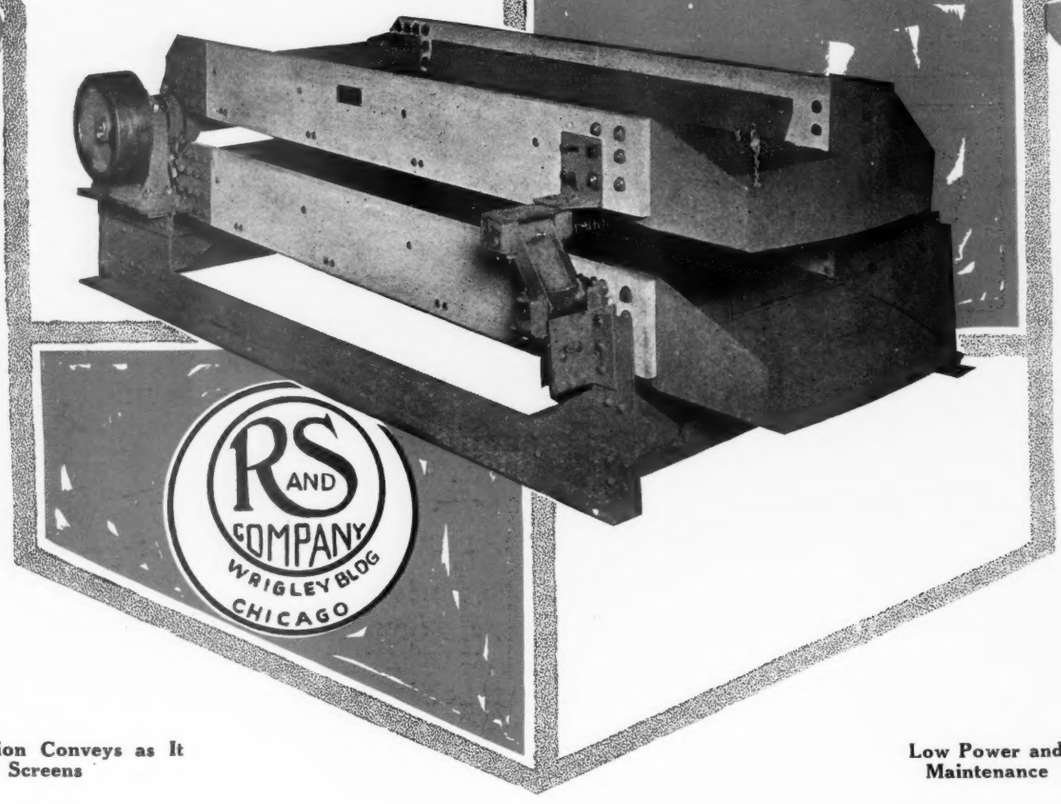

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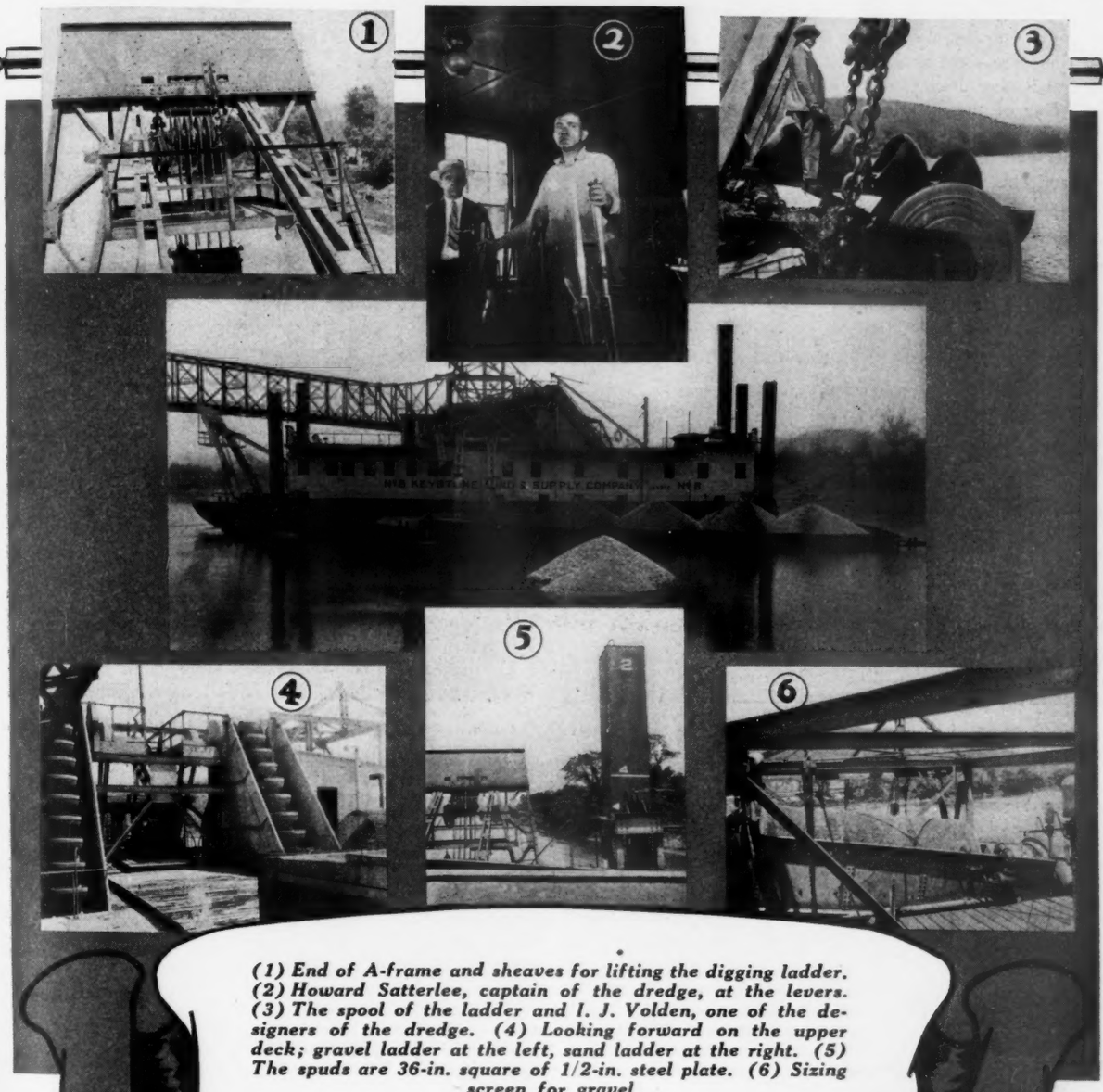


(1) End of A-frame and sheaves for lifting the digging ladder. (2) Howard Satterlee, captain of the dredge, at the levers. (3) The spool of the ladder and I. J. Volden, one of the designers of the dredge. (4) Looking forward on the upper deck; gravel ladder at the left, sand ladder at the right. (5) The spuds are 36-in. square of 1/2-in. steel plate. (6) Sizing screen for gravel

New Keystone Sand and Gravel Co.
Dredge at Pittsburgh, Penn.

Newest Gravel Dredge, Pittsburgh District

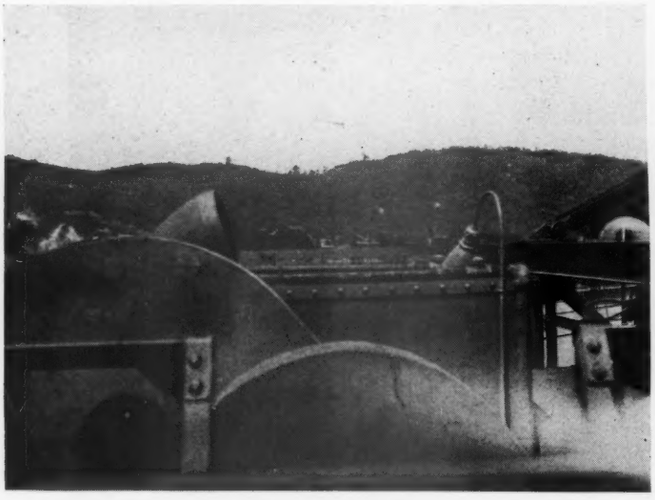
DREDGE No. 8 of the Keystone Sand and Supply Co. of Pittsburgh, Penn., was built by the Dravo Contracting Co. Pittsburgh, Pa., with which the Keystone company is affiliated. As the Dravo company has built dredges for use in various parts of the world (some of them larger than No. 8) and as the Keystone company has operated dredges for many years, it is presumable that this dredge embodies the best of what they have learned both in construction and operation.

There are no startling novelties in the design, but there are some notable differences between it and other dredges of recent construction. One of these is that—at a time when designers are turning more and more to electricity and oil engines—steam power with belt and chain drives was deliberately chosen. Another is that the bucket lines are of the close-connected type and a third is that variable-speed gearing has been introduced on the bucket lines that handle the sand and gravel from the screen, which is a much needed improvement that other dredge builders will probably appreciate.

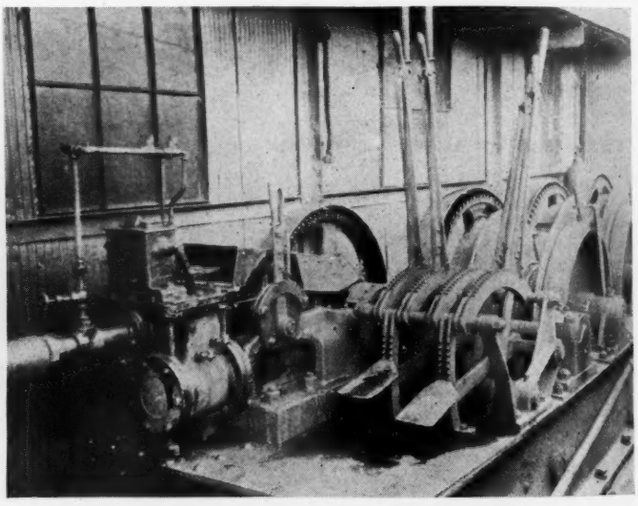
Considered only as an excavator, this dredge is an efficient machine. Its main bucket line is driven by a 125-hp. engine and with this power it digs a little over 10 tons per minute and it can keep up this speed indefinitely. As do all other dredges of this type, it contains a complete washing and screening plant so that it can turn out 400 tons an hour of washed and screened material, the oversize and the fine sand and clay being returned to the river. Ample water is used and a thorough rinsing is given the gravel, so the product is exceptionally clean.

The dredge hull is 155 ft. long and 44 ft. wide and draws 6 ft. of water with 2 ft. of freeboard. It is built of 5/16-in. plates with ⅜-in. bilge plates. The frames are of 7-in. channels. Two longitudinal bulkheads run the full length of the hull and between these is the well in which the digging ladder is hung. There are five transverse bulkheads dividing the hull into compartments. Each compartment is fitted with a steam siphon for bailing, but so far these have found little or no use. Inside and out the steel is thoroughly protected with paint.

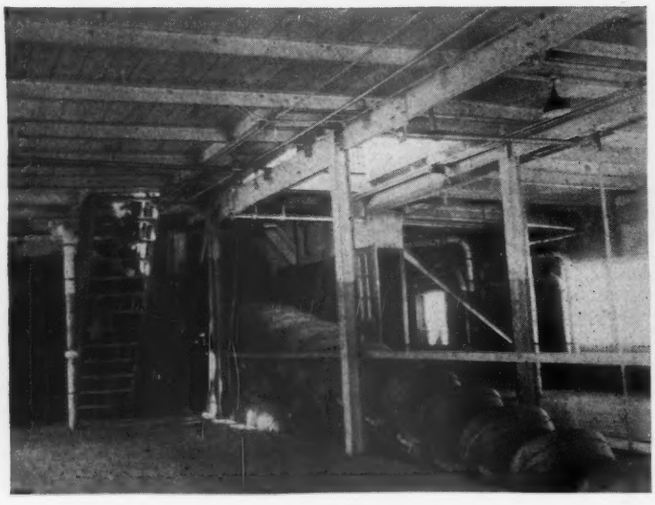
The digging ladder is very solidly constructed of plate and channel irons and is 90 ft. long. With the bucket line it weighs about 90 tons and when the buckets are loaded, as in digging, the weight is from 105 to 110 tons. It was calculated to withstand not only this weight but the severest strain it was possible for the engine to bring to



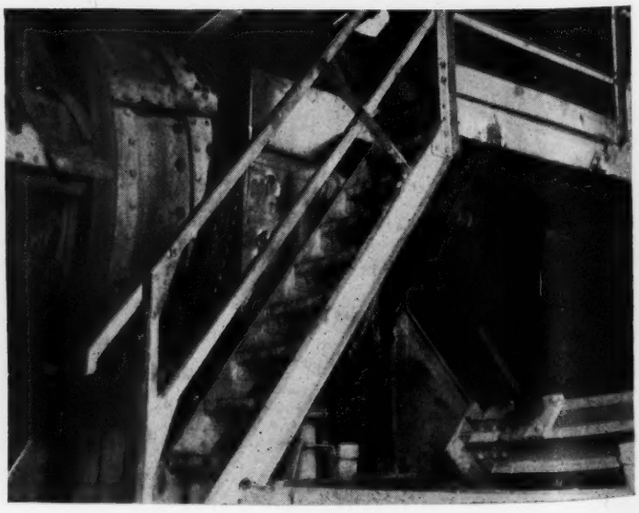
The very large steel gears (enclosed) that drive the gravel ladder



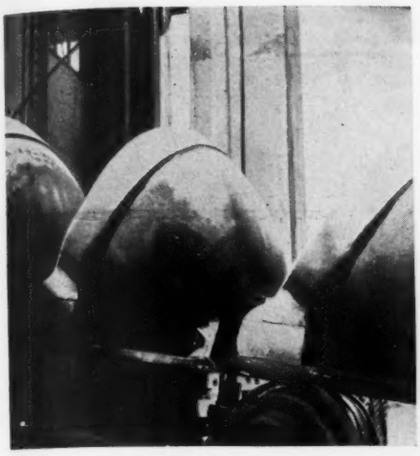
One of the 3-drum hoists used for warping barges and handling lines



Lower deck showing ladder in well



Enclosure of main screen



Buckets of dredge No. 8 are joined by lugs and pins to form a chain

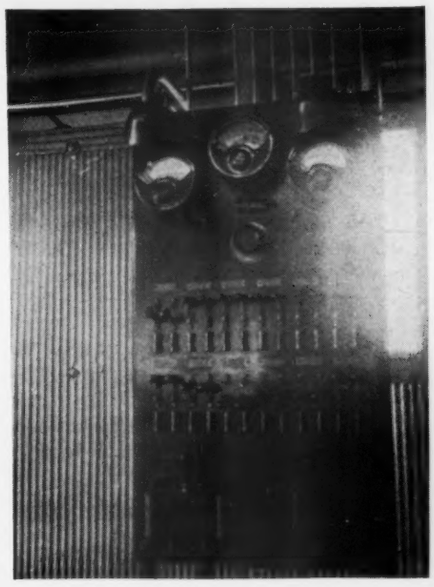
bear upon it in digging conglomerate.

The bucket line contains 83 buckets each of 6½ cu. ft. capacity. Each bucket is in the shape of a half bowl, cast in one piece of high carbon steel 0.35% to 0.50% carbon with a heavy band around the lip to resist the wear of digging. The bottom of the bucket is flat and has two lugs at the rear, forming a yoke, and a single broad lug in front. This broad lug fits in between the two rear lugs of the bucket behind it and thus forms a link in the chain of buckets. A pin passes through the lugs and is fitted together in the lugs that form the yoke and given a bearing fit in the broad center lug. This pin is 4¼-in. in diameter and is made of a special alloy furnished by the United Alloys Co., which contains nickel, chrome and vanadium steels.

The pin bears against a half bushing of cast manganese steel, and only a half bushing is needed as the strain is all one way when the bucket is digging and being drawn up.

The chain of buckets passes over a plain pulley, called the "spool," at the lower end of the ladder. This has broad flanges between which the buckets must pass and it is 4 ft. working diameter. At the upper end of the ladder the buckets pass over a "tumbler," which is a hexagonal pulley 2 ft. 4 in. on each flat side. This also has broad flanges. Both the spool and the tumbler are cast from manganese steel.

The ladder may be swung so that it is almost vertical, in which position it will dig 50 ft. below the surface of the water. This is sufficient to remove everything to bed rock at ordinary stages of the river. The buckets come in at the rate of 27 per minute, which makes the full capacity 6½ yd. per minute.



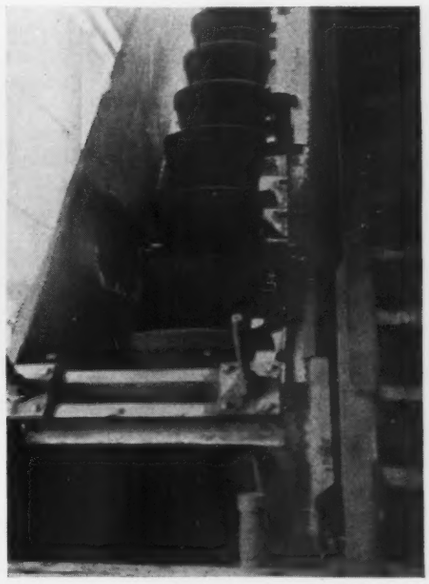
Engine room controls

Packed as it is by digging, the material in the buckets weights about 120 lb. per cu. ft.

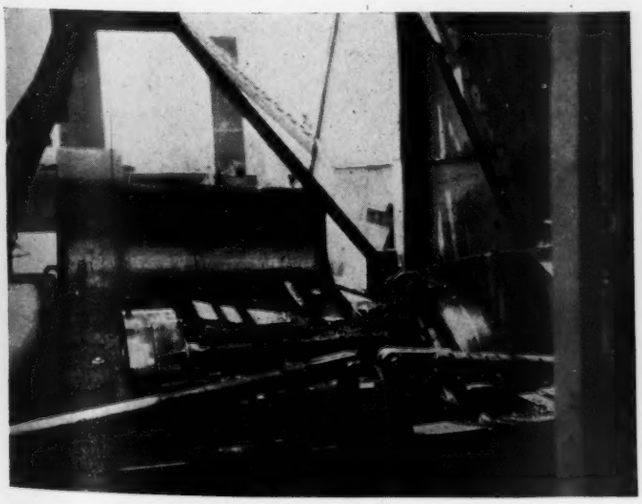
The drive of the bucket line is from a Hyde 125-hp. vertical compound engine with 9-in. and 18-in. cylinders of 12-in. stroke. The engine carries a 14-in. pulley and this is belted to an 84-in. pulley on a short shaft by a 14-in. belt. From this shaft the bucket line is driven by two large gears running in oil and fully enclosed in steel casings.

The buckets discharge into the main washing screen which is 72 in. in diameter and 30 ft. long (the main section) with a jacket 100 in. in diameter and 21 ft. long. The main section carries tire and trunnion bearings at both ends. The trunnions on the upper end are driven from a pair of miter gears which are driven by a chain from what might be called the main shaft of the dredge. The shaft has drives for the sand and gravel ladders as well as the screens and it is driven by a 125-hp. Hyde engine of the same type as that which drives the bucket line.

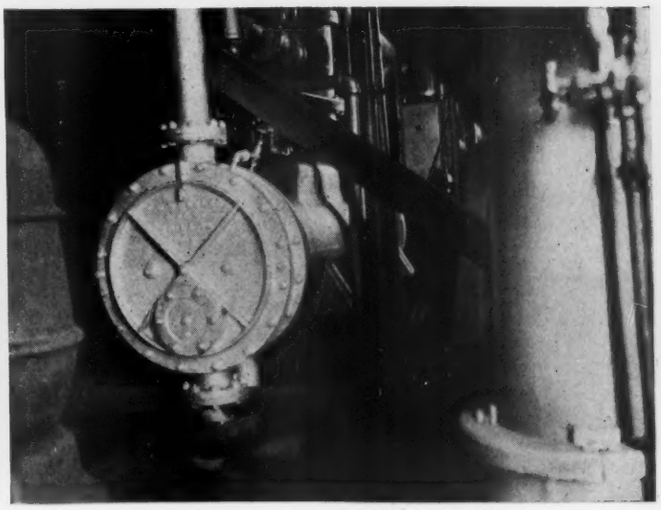
The drive on the trunnions of the main screen communicates its power to the tire of the screen by friction. This drive has on the whole proven satisfactory and there is no slippage, regardless of the load in the screen, so long as the trunnions are dry. When water is allowed to flow on the trunnions there is some slippage, but now that this is understood it is a simple matter to keep



Sand well and bucket ladder for raising sand

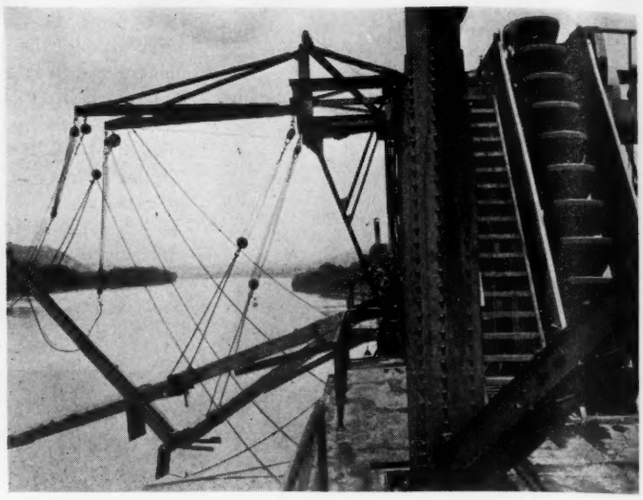


Cover over main shaft lifted showing clutches



Condenser for main engines

Sand chute with flap for guiding flow



Gravel chutes hung from cranes

water from the trunnions and avoid slippage altogether.

The screens are changed according to the orders received but on the day the dredge was visited the main section carried a 3¼-in. square hole screen and a 1¾x¾-in. screen. The smaller size is immaterial as the product of both sizes goes to another screen for sizing. The idea of putting two sizes of screen on the main section is to spread the material so that it gets a better wash from the sprays and so that it is better screened in the sand jacket. Of course the larger size opening in the main section follows the smaller size.

The sand jacket has 5/16-in. square-mesh openings. All the screen fabric is of high carbon steel. The 3¼-3¼-in. section is punched from plate. The other sections are of special steel wire furnished by the W. S. Tyler Co.

The main screen is set over a sloping pan on which the sand flows into the box of the sand ladder. The gravel runs from the screen into a chute and then to the gravel ladder. These sand and gravel ladders are set one on either side of the main screen.

Each of these ladders has a bucket line like that of the main digging ladder except that the buckets hold 4 cu. ft. instead of 6½ cu. ft. Each is of 50 ft. centers. The drive of these ladders is through a sprocket chain from the main shaft and large gears. These drives are unique in that each has a clutch and a transmission with three speeds like an automobile transmission. The purpose of the speed changes is to allow the two ladders to be run according to the proportions of sand and gravel to be handled. If the buckets are run too fast when a small amount of material is to be handled, too much water is brought up with the solids, and if the buckets are run too slow some material is lost in the overflow. This is a new idea in dredges of the ladder type but it has proven itself to be very successful on this dredge.

The gravel from the main screen, after being raised by the gravel ladder, goes to the sizing screen, the main section of which is 60 in. in diameter and 18 ft. long. The jacket is 84 in. in diameter and 12 ft. long. This screen makes a coarse and fine gravel, varied according to market requirements, and at times an oversize which is returned to the river. All the oversize of both screens is returned to the river in ordinary circumstances.

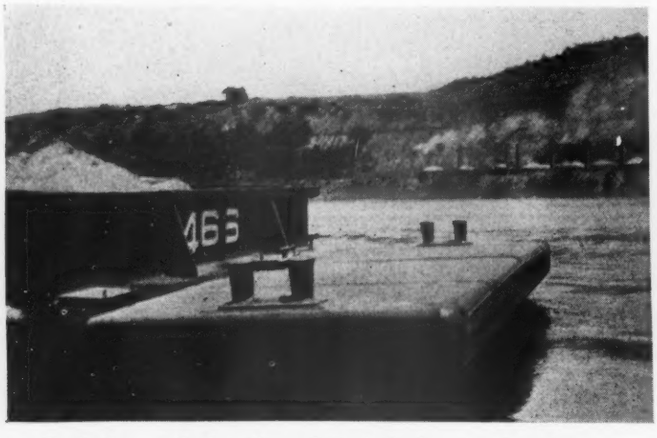
The sand after being raised by the sand ladder runs through a chute by which it is loaded on a barge. Formerly vibrating screens were used to make two sizes of sand but their use has been discontinued.

The chutes by which the gravel sizes are loaded are hung from cranes so that they may be swung to facilitate loading.

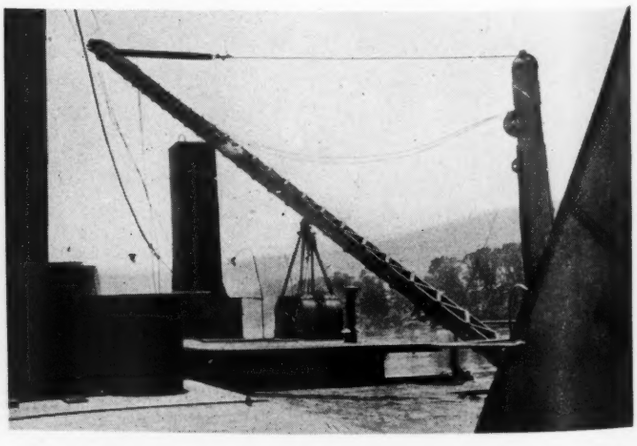
The dredge is abundantly supplied with machinery for mooring and handling and for warping barges into place alongside. There are four spuds on the dredge, each 36 in. square, of ½-in. steel, instead of the usual wood cornered with angle irons. Each spud is lifted with a grip which is fastened to a ⅞-in. cable that runs to a Lambert hoisting engine with 9x12-in. cylinders. A fifth engine of the same type and size, except that it has a wider drum, handles the digging ladder. The rope from this hoist runs through four sheaves forming a block which is hung on a heavily built A-frame on the bow of the dredge. A similar block of four sheaves is on a yoke on the end of the dredging ladder.

There are two 3-drum hoists of Dravo make using 6x6-in. crowding engines for power on either side of the dredge outside the house. These are used for warping barges into position.

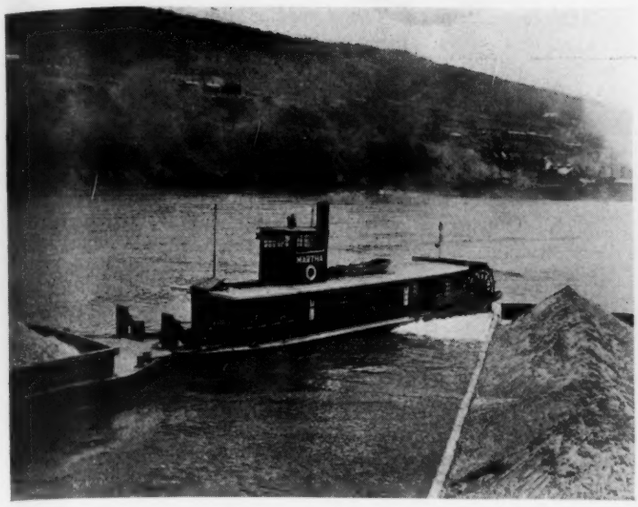
Shore and anchor lines are handled by these warping engines and there are steam capstans which may be used for warping or



End of one of the all-steel flush-deck cargo box barges

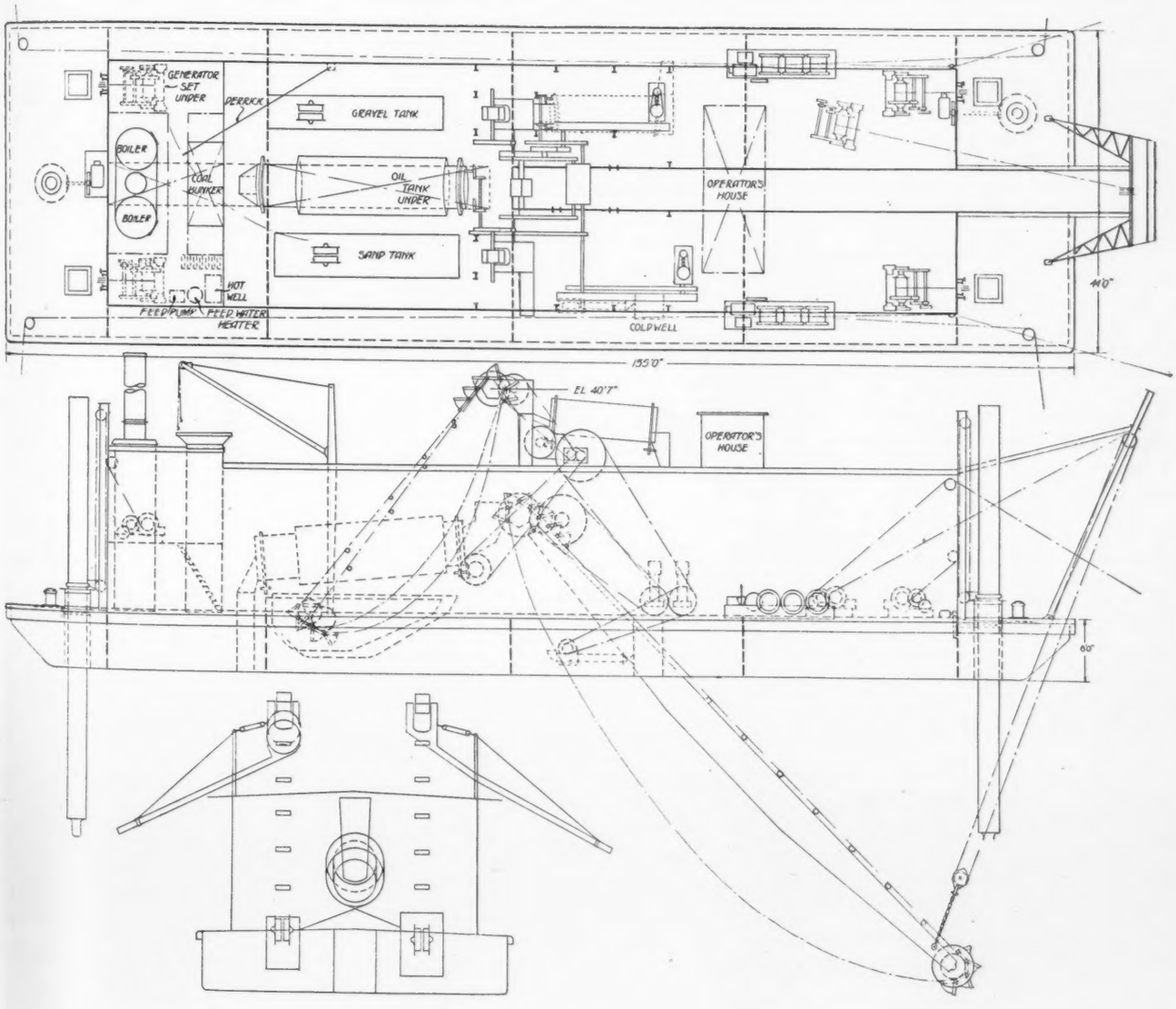


Hoist and 1-yd. clamshell bucket used for coaling the barge



Putting barges alonside the dredge. The towboat Martha shown was recently built especially for this work and is powered with a Diesel engine

Fleet of barges loaded with gravel. All barges are steel of the flush deck, cargo box type as introduced by the Keystone company



General plan and elevation of dredge No. 8 of the Keystone Sand and Supply Co., Pittsburgh, Penn.

handling lines when it is desired to do so.

The water supply for washing the sand and gravel is mainly from a 10-in. Lawrence centrifugal pump which throws 3000 g.p.m. For rinsing the gravel there is an 8-in. high pressure Worthington reciprocating pump which can also throw 3000 g.p.m. In addition there is a 6-in. centrifugal pump which can serve as a relief for the reciprocating pump if necessary.

The steam for all these engines is generated in two vertical upright boilers of Dravo design and make, placed in the extreme after part of the dredge. These are of the fire tube type and very high in proportion to their diameter. The upper part of the tubes forms a super-heater and baffles are arranged in the upper part of the shell to throw the heat back and forth through the tubes. This arrangement gives about 125 deg. superheat to the steam. The boiler pressure carried is 150 lb.

The boilers are fired with coal by hand. Coal is carried in a bin, like a vertical chute, holding 40 tons and about 25 ft. high. At the bottom of this bin are two doors of a size to easily admit a coal scoop, but the arrangement is such that the coal flows to a point in front of the door from which it can easily be picked up by the fireman's shovel.

In coaling, a barge of coal is brought alongside and unloaded by a ¾-yd. Williams clamshell bucket. This is hung on a crane so that the bucket may be brought inboard and swung over the coal bin.

For handling gravel chutes there are two hand winches of Dravo make.

The levers by which practically every piece of machinery on the dredge is controlled are in a cabin placed over the digging ladder. This is large and well lighted and the levers are so arranged that they are easily reached from one position. The floor of this cabin and the floor of the storeroom below are of wood, but all the other floors are of steel, most of them roughened to prevent slipping.

All the barges that are used with this dredge are of steel and all are of the flush deck, cargo box type which the Keystone company introduced in the Pittsburgh district some years ago. The towboat *Martha,* which was quite recently constructed by the Dravo company is engaged in towing them and others to landings. It is powered with a Diesel engine and has a stern wheel.

After seeing this dredge at work one must admit that there are advantages in using a direct steam drive for such a machine. It is admitted that the fuel consumption is considerably greater. On the other hand, as every steam shovel runner will tell you, steam has many advantages for driving excavating machinery. These advantages may be summed up in the often heard remark that: "When the limit is reached, electricity and gas quit, but steam keeps trying." In building a dredge of this kind direct steam drive calls for a smaller investment and such a dredge requires less expensive labor to operate than one which has many electric motors. In other cases the advantages of oil and electric drives may quite outweigh the advantages for steam so the matter is one to be decided by particular load conditions to be met. But to judge from this dredge direct steam drive is by no means obsolete.

The officers of the Keystone Sand and Supply Co. are: President, R. M. Dravo; vice president, F. R. Dravo; vice president and treasurer, Alex W. Dann; secretary, W. A. Bliss; superintendents, A. J. Hippert, William MacLachlan, R. J. Grab, R. Jones, C. Muirhead and F. Eyman. The offices are at 300 Penn Ave., Pittsburgh, Penn.

Dredging Gravel Said to Lower Level of Great Lakes

DREDGING gravel has entered the field of international politics. The taking of gravel from the St. Clair river near Detroit is asserted by two United States government engineers to be one of the principal causes for the lowering of the levels of the Great Lakes. This lowering of lake levels has been a subject of much controversy among the states and cities in the Great Lakes basin and to some extent between the United States and Canada. It is complicated by the proposals to connect the Great Lakes with the Atlantic by means of a ship canal and to connect them with the Gulf of Mexico by a barge canal leading into the Mississippi. Violent advocacy for and opposition to these proposals has developed, the opposition being based on the assumption that a drainage canal long in use in Chicago has already lowered lake levels and that any further taking of water from the lakes would be disastrous.

The Canadian government has checked the dredging of gravel in the St. Clair river on account of the protest of Col. E. J. Dent, district engineer for the United States, made by authority of the War Department. According to the *Chicago Tribune,* Col. Dent said:

"The head of the St. Clair river, where the Canadian government permitted extensive dredging for gravel, is the critical point of the Lake Huron outlet. Lowering the river bed there undoubtedly lowers the levels of the lakes above, Michigan and Huron.

"We made a complete survey of the project, and were brought to the conclusion that the dredgers had done a great damage, and that the gravel removal had been an important factor in lowering lake levels and menacing navigation."

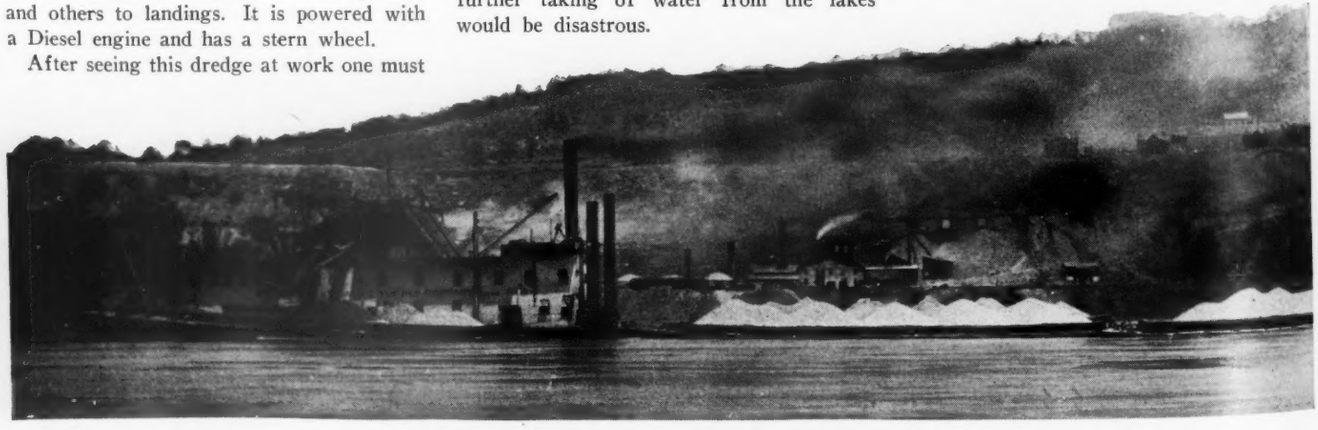
Regarding the effect of dredging at other points Col. Dent said:

"There are other points in the waterway connecting Lake Huron to Lake Erie at which sand dredging has been done, but in those places the river slope is so slight that the removal is wholly inconsequential."

Col. George R. Pilsbury, the other engineer who is credited with asserting that the lake levels had been lowered by dredging gravel in the St. Clair, would make no statement for publication, as he is a member of the international joint commission studying the Great Lakes - St. Lawrence waterway.

Evansville Sand and Gravel Co. in Receivership

THE Mercantile Commercial Bank of Evansville, Ind., was appointed receiver for the Evansville Sand and Gravel Co. by Judge Elmer Q. Lockyear, of the Vanderburgh county superior court at Evansville, as a result of a suit filed in the probate court by Tessie F. Lowenthal asking for the appointment of a receiver and judgment of $2500 against the company on a promissory note. The suit charged that the company was in danger of becoming insolvent and that it had failed to pay a note for $1320, which was long overdue. The complaint also stated that recent high water along the rivers in southern Indiana had prevented work by the company.—*Evansville (Ind.) Press.*



Dredge No. 8 of the Keystone Sand and Supply Co.

Plant of the Utah Sand and Gravel Products Co., Salt Lake City, Utah. This is one of the few plants producing washed and screened aggregate between Denver and the Pacific coast

Efficient Hillside Gravel Plant of Utah

Utah Sand and Gravel Products Company Produces 1200 Tons per Day with Only Nine Men

ALTHOUGH hillside operations are quite common on the West coast and through California, the plant of the Utah Sand and Gravel Products Co. at Salt Lake City, Utah, is deserving of more than casual mention. It is the only washing plant, with possibly one exception, between Denver and the Coast, some 1500 miles.

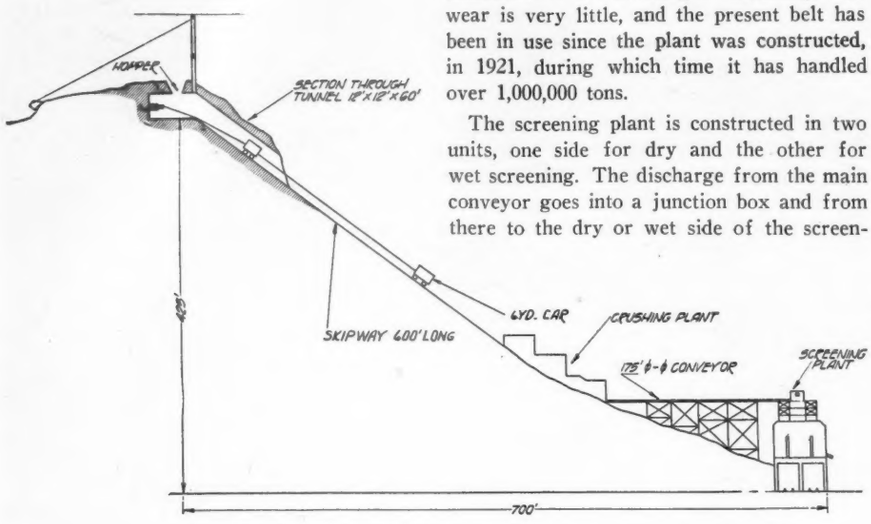
This company has really pioneered the sand and gravel industry in this territory, for up to a few years ago there was no recognized industry here. The country about is rich in sand and gravel and the material was there practically for the asking. Under these conditions the task of the Utah company was a real one.

Considering the apathy with which the project was first looked upon by contractors and users of rock products materials, the success of the company has been phenomenal. They have been able to build up a good demand for clean washed sand and gravel and their 1200-ton capacity is kept pretty busy taking care of it.

The site on which the plant was constructed is ideal. It is situated within the city limits and provided with track connections to three railway trunk lines and two electric lines. The plant is located at the base of a spur of the Wasatch Range of mountains, whose slopes are marked by three great benches which represent the different periods of inundation of what is known in geologic history as Lake Bonneville or Great Salt Lake. As the waters of this inland sea receded by periods they left deposited on these benches great deposits of sand and gravel.

The particular deposit lying in the property of this company has been estimated to contain over 10,000,000 yd. of sand and gravel, running about 15% sand and 85% gravel, 75% of which is under 2-in. Underneath this deposit of gravel, at a depth of about 200 ft., there is a fine stratum of limestone, and the plant was constructed with the idea that ultimately it could be used for a crushed stone plant.

As was stated, the plant is a hillside operation. Material is handled by a 3-yd. Sauerman "Crescent" drag scraper on a 60-ft. boom situated about 700 ft. back from the screening plant and at a point about 425 ft. above it. The drag-scraper is driven through a 2-drum Thomas hoist and 100-hp. General Electric motor, direct connected. It is dumped over a bar grizzly and hopper directly underneath. This hopper is situated at the end of a tunnel about 60 ft. long and 12x12 ft. Two steel end-dump cars of 6 yd. capacity each, and of the company's own make, operate in this tunnel, and on the skipway, which is 600 ft. long. There is a single 36-in. gage track in the tunnel, but loaded and full cars are switched automatically on a "Y" switch about 100 ft. below the mouth of the tunnel. 1⅛-in. Leschen wire rope over a 60-in. sheave is used on the skipway. An operator is stationed at the sheave and the hopper and takes care of both the loading and manipulation of the cars on the skipway.



Profile through hill showing operation scheme

centers, 24 in. wide, 5-ply Goodyear belt, and is supported on a horizontal trestle. Inasmuch as no elevating is necessary, belt wear is very little, and the present belt has been in use since the plant was constructed, in 1921, during which time it has handled over 1,000,000 tons.

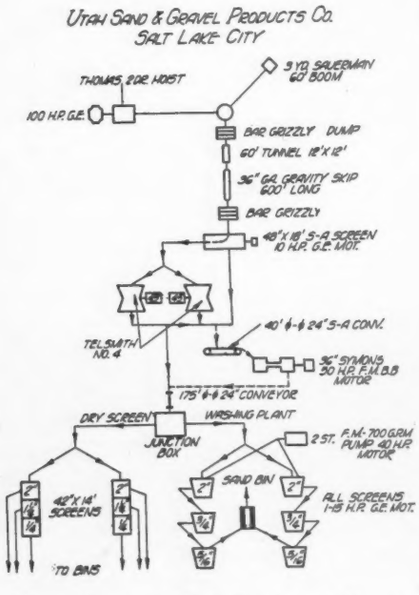
The screening plant is constructed in two units, one side for dry and the other for wet screening. The discharge from the main conveyor goes into a junction box and from there to the dry or wet side of the screening plant as desired. The wet side equipment includes six 36 and 52¾ in. diameter x 72-in. Gilbert screens, arranged in two rows, with perforations of 2 in., ¾ in. and 5/16 in. respectively. Screenings from the last section with 5/16-in. perforation along with the water flows by gravity to hydraulic classifiers; the spigot product of these classifiers drops to the receiving tanks of two drag classifying and dewatering machines. The screens are so arranged that any combination of sizes as desired can be secured.

Water is furnished at the rate of 700 g.p.m. by a 2-stage Fairbanks-Morse pump direct driven through a 40-hp. Fairbanks-Morse motor situated in pump house about 100 ft. from the plant. The waste water from the screens goes through a flume to a sump about 150 ft. away from the plant.

The dry side of the screen is equipped with two 42-in. x 14-ft. Stephens-Adamson screens in three sections, perforated for ¼-in., 1¼ in. and 2 in. respectively. Screenings drop into bins. Here, too, the chutes to bins

At the end of the skipway another bar grizzly is located over the main scalping screen, of Stephens-Adamson make, which is 48 in. x 18 ft. and perforated for 2½ in. The cars are dumped automatically on to this grizzly. Oversize from the screen, which is driven by a 20-hp. General Electric motor, passes to one of two No. 4 Telsmith crushers driven through 45-hp. motors. If necessary the material can now be shunted over a 40-ft. center 24-in. Stephens-Adamson conveyor into a 36-in. Symons disc crusher, driven through a 50-hp. Fairbanks-Morse ball bearing motor, or can be passed on to the main conveyor and to the screening plant. The screenings are mixed with the discharge from the Telsmith crushers.

The main conveyor which handles all the material passing through the plant is 175-ft.



Flow sheet of Utah Sand and Gravel Products Co. plant

General view of Utah Sand and Gravel Products Co. operation near Salt Lake City

are arranged so that any combination of sizes may be obtained.

Bins are of concrete and wood and are built directly over loading tracks. Truck loading facilities are provided at the sides. The cars are spotted by gravity. When placed by the railroad company they are set at a point about 250 ft. from bins and on a slight grade so that when the brakes are released they drop by gravity to the loading bins.

The normal operating crew of the plant consists of nine men, one at the scraper hoist, one at the tunnel grizzly, one at the skip control at end of tunnel, two at the automatic dump and scalping screen, one at crushers who also attends to normal duties at screening plant, two men loading cars and one man loading and dispatching trucks. Completing this plant operating organiza-

DAILY SUMMARY SHEET
UTAH SAND & GRAVEL CO.
SALT LAKE CITY, UTAH

DATE
YEAR

MISCELLANEOUS JOURNAL ENTRIES

ITEMS	ACCT NO	DEBIT	ACCT. NO.	CREDIT

GENERAL LEDGER TRIAL BALANCE

NAME OF ACCOUNT	ACCT. NO.	BALANCE TO DATE
ASSETS (CLEAR)		
CASH	101	
BANK	102	
STOCKS	103	
BOND COLLATERAL	104	
BOND DISCT RESERVE	105	
STOCK COMM RESERVE	106	
ACCTS. RECEIVABLE	107	
NOTES RECEIVABLE	108	
NOTES RECEIVABLE (EMP.)	109	
UNEXPIRED INSURANCE	110	
ELEC SERVICE ADVANCES	111	
DEPOSITS	112	
SUSPENSE	113	
FURNITURE & FIXTURES	114	
AUTO EQUIPMENT	115	
TOOLS	116	
PLANT DEVELOPMENT	117	
SUPPLIES	118	
OTHER ASSETS	119	
REAL ESTATE— S.L.	120	
REAL ESTATE—TAY	121	
MACHINERY & EQUIPT — S.L.	130	
MACHINERY & EQUIPT —TAY	131	
BLDGS., BINS & TRACKS— S.L.	140	
BLDGS. BINS & TRACKS—TAY	141	
PIPE LINES —S.L.	150	
PIPE LINES—TAY	151	
(SUB-TOTAL) TOTAL ASSETS		
LIABILITIES:		
CAPITAL STOCK	201	
BONDS	202	
BOND SINKING FUND	203	
SURPLUS	204	
PROFIT & LOSS	205	
RESERVE FOR DEPRECIATION	206	
RESERVE FOR DEPLETION & ROYALTY	207	
ADVANCES	208	
ACCRUED INTEREST	209	
ACCRUED TAXES	210	
NOTES PAYABLE COLLATERAL	211	
NOTES PAYABLE	212	
ACCOUNTS PAYABLE	213	
	214	
	215	
(CLEAR) APP NET WORTH		
REVENUES		
SALES S. L	301	
SALES, TAY.	302	
TRUCKAGE SOLD	303	
DISCOUNTS TAKEN	304	
EQUIPMENT RENTAL	305	
MISCELLANEOUS	306	
(CLEAR) TOTAL REVENUES	250	
TONNAGE ACCOUNTS: (MEMO:)		
(ADD) TONNAGE MANUFACTURED	397	
(SUBT.) TONNAGE SOLD	398	
(CLEAR) TONNAGE STORED	399	
EXPENSE CONTROLS:		
MAINTENANCE & REPAIR—LABOR	400	
MAINTENANCE & REPAIR—MATERIAL	500	
OPERATING EXPENSE—LABOR	600	
OPERATING EXPENSE—GENERAL	650	
TRUCKAGE	690	
GENERAL OVERHEAD	700	
ADMINISTRATION	750	
OFFICE EXPENSE	800	
MISCELLANEOUS	900	
(SUB-TOTAL) TOTAL EXP		
(SUBTRACT) TOTAL REV		
PROFIT (CR)		
LOSS (DR)		

DETAIL OF EXPENSE AND COSTS

ACCOUNT	ACCT. NO.	TOTAL TO DATE	ACCOUNT	ACCT. NO.	TOTAL TO DATE
MAINT & REPAIRS—LABOR	400		GENERAL OVERHEAD	700	
PIT & HOIST	401		ADVERTISING	701	
TUNNELS & TRAMWAY	402		TEL. & TELG.	702	
BINS	403		INTEREST PAID	703	
CRUSHERS	404		DISCTS & ALLCE GIVEN	704	
CONVEYOR & FEEDER	405		SALES ADJUSTMENTS	705	
CHUTES	406		TAXES	706	
SCREENS	407		INSURANCE	707	
PUMPS & PIPE LINES	408		SURETY BONDS	708	
SETTLING POND	409		LEGAL EXPENSE	709	
SHOP	410		TRAVELING	710	
SUPERVISION	411				
			AUTOMOBILES	711	
MAINT & REP —MATERIALS	500		BOND DISCT EXPENSE	712	
PIT & HOIST	501		STOCK COMM EXPENSE	713	
TUNNELS & TRAMWAYS	502			714	
BINS	503			715	
CRUSHERS	504		MISCELLANEOUS	720	
CONVEYOR & FEEDER	505				
CHUTES	506		ADMINISTRATIVE SALARIES	750	
SCREENS	507				
PUMPS & PIPE LINES	508		OFFICE EXPENSE	800	
SETTLING POND	509		SALARIES	801	
SHOP	510		POSTAGE, PRINTING & STAT'Y	802	
	511		MISCELLANEOUS	803	
GENL & MISC	512				
OPERATING EXP —LABOR	600		MISCELLANEOUS EXPENSE	900	
PIT & HOIST	601				
TUNNELS & TRAMWAY	602		MISCELLANEOUS	901	
CRUSHING	604		SUSPENSE	902	
SCREENING	607				
SUPERVISION	611				
LOADING &ILLING & YARD	621		TOTAL		
STORAGE	622				
OPERATING EXP —GEN	650				
LEASE RENTAL	651				
WATER	652				
POWER	653				
SWITCHING CHARGES	654				
FREIGHT	655				
INDUSTRIAL INSURANCE	656				
OILS & LUBRICANTS	660				
TRANSF OIL	661				
CRUSHER OIL	662				
MOTOR OIL	663				
GEAR GREASE	664				
MISCELLANEOUS	665				
OPERATING SALARIES	670				

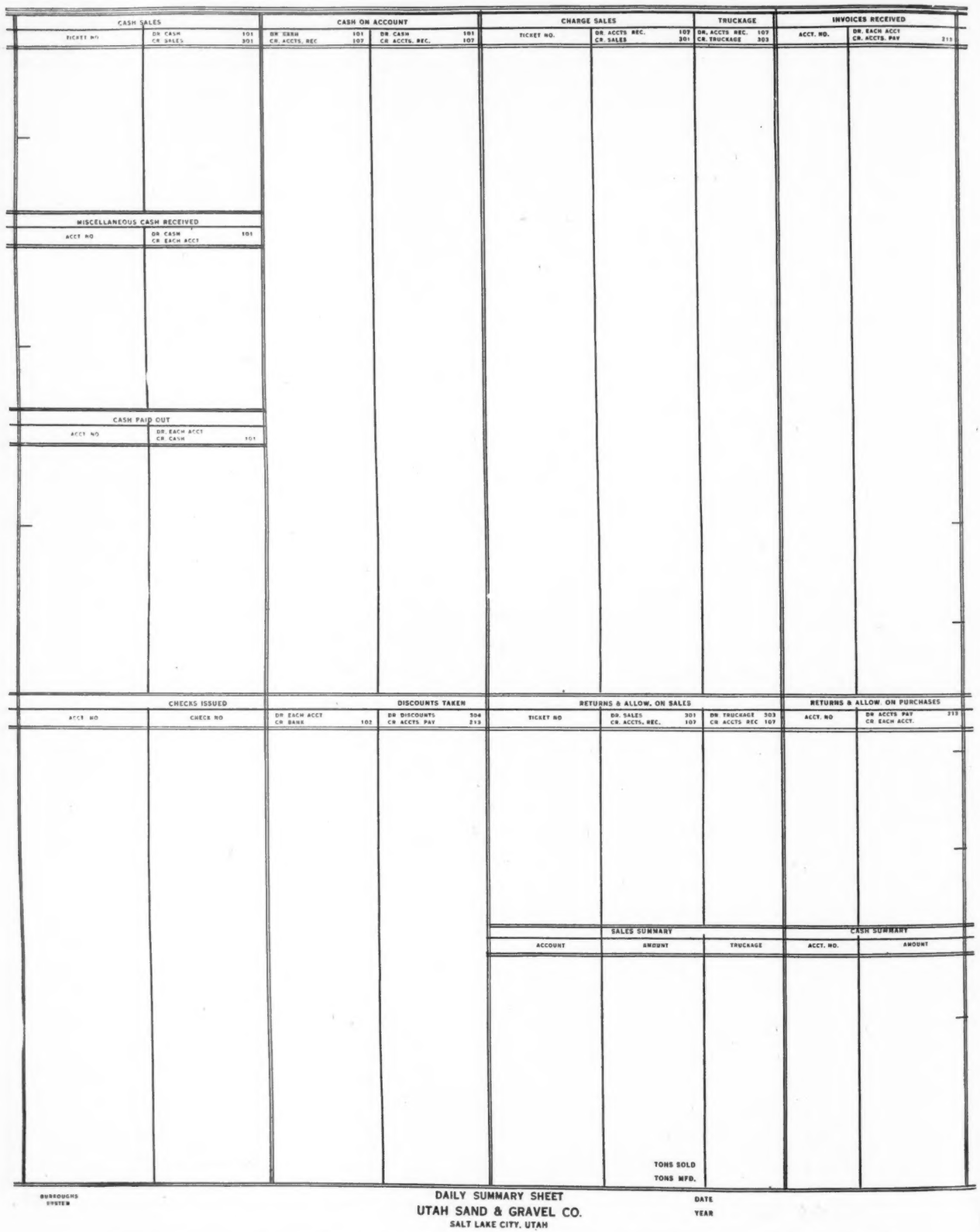
DATE
YEAR

Reproduction of ledger sheet in use at the Utah Sand and Gravel Products Co. Practically all the possible items of expense in the plant are indicated. By reference to the reverse side a summarized profit or loss statement can be drawn

tion is the manager, superintendent and accountant.

It may be added that several members of the above crew are fair mechanics and all maintenance and reasonable repairs to plant is done with the operating force. A small machine and blacksmith shop equipped with power tools, acetylene outfit, forge and etc., is part of the company's plant equipment, making possible most all repairs at the plant. The normal production is 1200 tons daily. Power is purchased from a local power company and a total of 400 hp. is required. 3-phase, 220-volt current is used.

The company is at this time drawing plans for extensive additions to its plant. As above stated, the gravel deposit is underlaid with a very hard, clean lime rock, suitable for concrete purposes and especially desirable for all types of asphalt pavement. At the present time they are producing a



Reverse side of ledger sheet. This is for recording in detail, money received and paid out daily

crushed stone from their run-of-pit oversize, 2½-in. plus. But the demand has increased to such a point that it has been necessary to open up an exclusive stone source, which fortunately is right in their back yard so to speak. In fact the quarry they will work is nearer to the plant than the sand and gravel deposit.

As noted, they now have a very complete and efficient secondary crushing unit and the screening plant is designed for dry stone and washed sand and gravel screening. All the facilities for crushing excepting equipment to recover the rock at the quarry and convey it to the secondary crushing unit is on hand.

The plans include a primary crusher at the quarry to break rock down to 6-in. minus and a 600 to 700-ft. 24-in. conveyor from the primary crusher to their present secondary crushing unit. Then an individual conveyor from the secondary crushing plant to the dry screening plant. This will make a stone crushing plant and washing plant in one and each will be separate in its operation. Both could be operated simultaneously without one affecting the other, or either could be operated while the other is down.

In connection with this installation, it is contemplated to install a belt conveyor storage system to store both crushed stone and sand and gravel. This conveyor is designed to store approximately 20,000 cu. yd. of material.

The third addition is the installation of a recovery conveyor in the sand and gravel deposit. At this writing the power drag scraper is forced to capacity in endeavoring to keep the plant under full operating head. Due to the length of the haul it has to drag the material about 750 ft. to a tunnel dump. The plan is to install a 30-in. conveyor from the tunnel dump up to the sand and gravel source and there load the belt through a hopper grizzly, loading to be done by the power scraper.

With these improvements it is contemplated that the plant production will be increased considerably, and that it will be one of the most flexible plant in the United States for the furnishing of various stone products.

Inasmuch as the plant is built along the side of a hill which is quite close to the main highway, it is quite a prominent feature of the landscape, and the company is capitalizing on this in their advertising and merchandising plans. Photographs of the plant and interesting facts concerning it are printed on attractive blotters and used as mailing pieces to all customers and prospects. This literature is all designed to educate the users of concrete to the importance of good materials, and to appreciate the real economic value of the sand and gravel industry to general industrial progress. They have been very favorably received by the consuming public.

Further evidence of the live and efficient methods used by the management in the promotion of the plant is best witnessed by the excellent system of cost accounting in use. Through this a daily profit or loss statement is possible, for every possible item of expense or revenue can be included on the ledger sheet, of which reproductions of both sides are shown in the accompanying cuts. This system was instituted under the direction of Eric Ryberg, vice president and general manager of the company.

Besides Mr. Ryberg, the other officers are H. E. Hatch, president; J. E. Hatch, secretary-treasurer. L. D. Mortensen is superintendent.

Rock Products Have Prominent Places in Table of Mineral Wealth

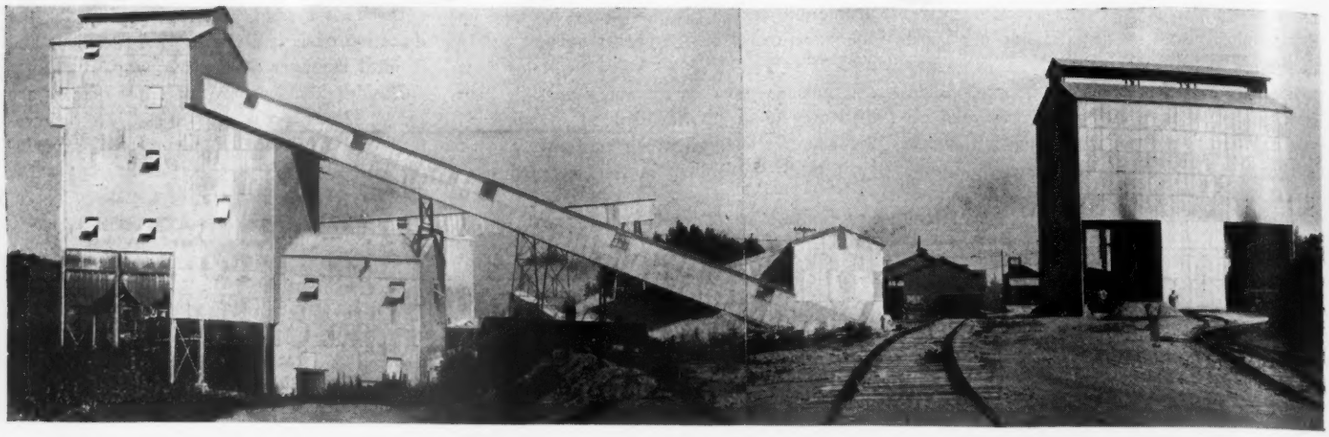
How the States Rank in Mineral Production

PENNSYLVANIA, with its enormous coal output, led all the states in the production of minerals in 1924, the latest year for which complete figures are available, according to the Bureau of Mines, Department of Commerce. The commonwealth's mineral production in that year amounted to $1,011,630,879 and constituted 21.64% of the nation's entire mineral output. In addition to coal, the state was a large producer of cement, clay products and natural gas. California ranked second as a mineral producing state, its tremendous production of petroleum, natural gas, cement and natural-gas gasoline comprising the bulk of its mineral output valued at $428,175,652. Oklahoma, with production valued at $393,030,665, made up largely of petroleum, zinc, natural gas and natural-gas gasoline, ranked third.

West Virginia, whose coal, natural gas, petroleum and clay products constituted the bulk of its mineral production valued at $307,314,205, ranked fourth. Texas was the fifth state, its production valued at $272,729,023, being largely comprised of petroleum, sulphur, natural-gas gasoline and natural gas.

The relative rank of the other states, with the minerals constituting the bulk of their production, is indicated in the following table:

Ohio—Clay products, coal, natural gas, petroleum	$249,049,648
Illinois—Coal, clay products, petroleum, *cement*	235,796,027
Kentucky—Coal, petroleum, clay products, natural gas	120,510,775
Michigan—Iron ore, copper, *cement*, clay products	114,239,386
Indiana — Coal, *cement, stone*, clay products	112,299,075
Minnesota — Iron ore, *cement, stone*, clay products	107,844,680
Kansas—Petroleum, zinc, coal, natural gas	105,005,476
Arizona — Copper, gold, silver, lead	100,325,413
New York—Clay products, *gypsum, cement, stone*	95,435,299
Utah—Copper, lead, coal, silver	84,356,626
Missouri — Lead, clay products, *cement*, coal	81,054,122
Alabama — Coal, iron ore, *cement*, clay products	77,315,758
Wyoming—Petroleum, coal, natural gas, natural-gas gasoline	75,494,166
New Jersey—Clay products, zinc, *cement, sand* and *gravel*	75,271,009
Montana — Copper, silver, coal, zinc	70,631,806
Arkansas—Petroleum, coal, natural gas, bauxite	61,748,999
Colorado—Coal, gold, clay products, lead	61,487,882
Louisiana — Petroleum, sulphur, natural gas, natural-gas gasoline	56,930,681
Iowa—Coal, *cement*, clay products, *gypsum*	40,459,869
Virginia — Coal, clay products, *stone, cement*	37,962,143
Tennessee — Coal, *cement*, clay products, *stone*	35,354,525
Idaho—Lead, silver, zinc, gold	27,831,623
Nevada — Copper, silver, gold, *gypsum*	26,225,943
New Mexico—Copper, coal, zinc, silver	23,913,528
Washington—Coal, *cement*, clay products, *stone*	21,159,370
Maryland — *Cement*, coal, clay products, *sand* and *gravel*	18,506,867
Alaska—Copper, gold, coal, silver	17,361,834
Wisconsin — *Stone, sand* and *gravel, lime*, iron ore	15,796,720
Massachusetts—*Stone*, clay products, *lime, sand* and *gravel*	15,725,882
Georgia — Clay products, *stone, cement, fuller's earth*	14,946,610
Vermont—*Stone, slate, lime, talc*	14,549,429
Florida—*Phosphate rock, stone, fuller's earth, sand* and *gravel*	13,101,223
North Carolina—Clay products, *stone, sand* and *gravel, feldspar*	9,261,467
Connecticut — Clay products, *stone, sand* and *gravel, lime*	8,129,332
Oregon—*Cement, stone, sand* and *gravel*, clay products	7,364,232
South Dakota—Gold, *stone, sand* and *gravel*, silver	6,884,433
Maine—*Stone, lime*, clay products, *slate*	6,035,160
South Carolina — *Stone*, clay products, *sand* and *gravel, calcareous marl*	3,444,366
New Hampshire — *Stone*, clay products, *sand* and *gravel, feldspar*	3,378,165
Nebraska—*Sand* and *gravel, cement*, clay products, *stone*	3,209,425
North Dakota—Coal, clay products, *sand* and *gravel*, tungsten ore	2,776,720
Mississippi — *Sand* and *gravel*, clay products, *stone*	2,090,422
Rhode Island—*Stone*, clay products, *lime, sand* and *gravel*	1,132,641
District of Columbia—*Sand* and *gravel*, clay products, *sand-lime brick, stone*	813,608
Delaware—*Stone*, clay products, *sand* and *gravel*	512,105



Panorama view of the new crushing and screening plant. It is built of steel construction throughout

Beauty and Simplicity Are Built into This Big Quarry Plant

New Plant of Lake Erie Limestone Co. Is an Excellent Example of Modern Construction, Being of Steel and Concrete Throughout

By George M. Earnshaw

APPARENTLY no reasonable expense was spared by the Lake Erie Limestone Co., Hillsville, Pa., in building its new 250-ton-per-hour crushing and screening plant, for in the writer's opinion, it is constructed as fine as a plant can be built. Every inch of it, excepting its concrete foundations is of heavy steel construction and its design and equipment are most modern in every detail.

The box-like building shown at the right in the large photograph on this page houses only the primary crusher. This building measures 32x57 ft., 51 ft. high. This height is of course necessary for the removal of the crusher shaft and head for repairs. A 30-ton Chrisholm-Moore trolley-mounted chain hoist runs the full length of the building on rails 44 ft. above the floor level.

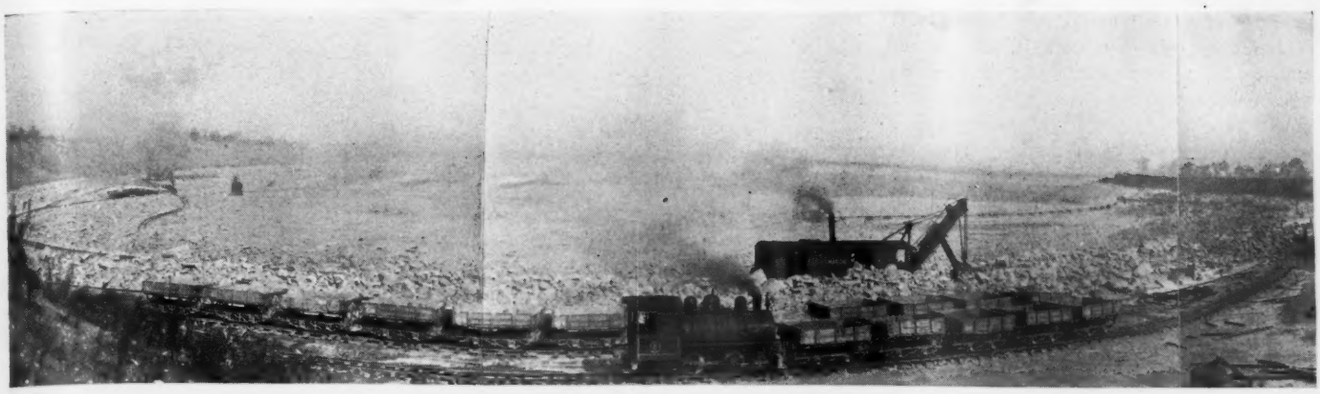
The primary breaker is a No. 21 Allis-Chalmers gyratory, set to discharge at 5⅞ in., which is its smallest opening. The speed of the shaft has been reduced to 250 r.p.m. for it is believed that this slow speed affords the making of a larger proportion of fine sizes. The feeding and dumping floor is fitted with the usual equipment for car dumping and handling of large rocks in the crusher.

Screenings conveyor running from sizing screens to outside storage

Stone from the crusher is discharged into a steel box with sliding-plate bottom directly to the main conveyor which runs under the tracks to the screening and secondary-crushing plant. This conveyor installation is interesting because it is mounted at a 20-deg. incline, which is somewhat steeper than usually designed. It operates quite successfully, however, and no spillage or waste of stone could be seen.

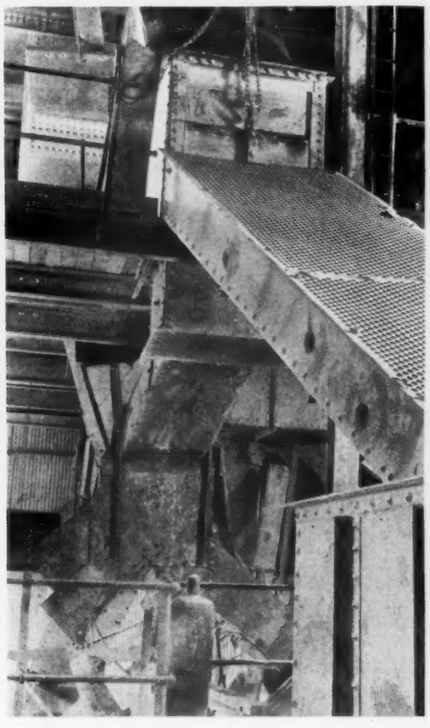
The belt is 42 in. wide (made by the Re-

These two views show one of the rock-loading shovels and how block drilling is done



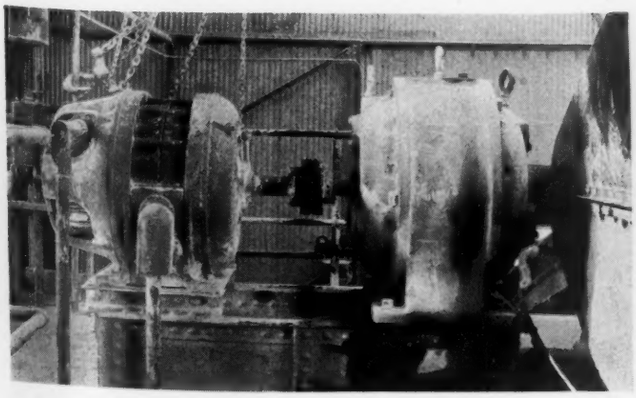
Panorama showing the entire quarry. It is located about three-quarters mile from the plant

The No. 5 crusher showing its belt drive

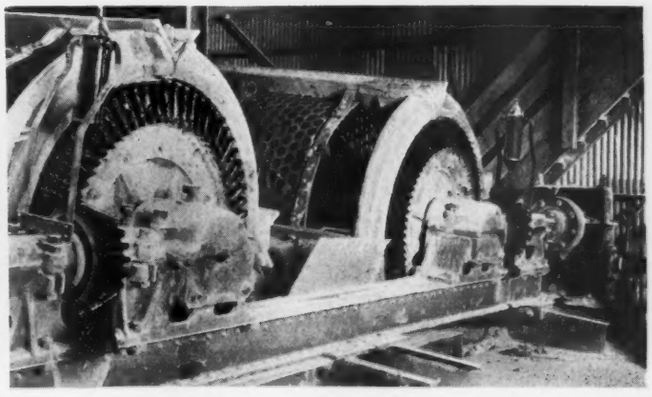


Steel chute between scalping screen and No. 8 crusher

Conveyor for products of the secondary scalper and No. 5 crusher



Motor driving the main conveyor through a speed reducer

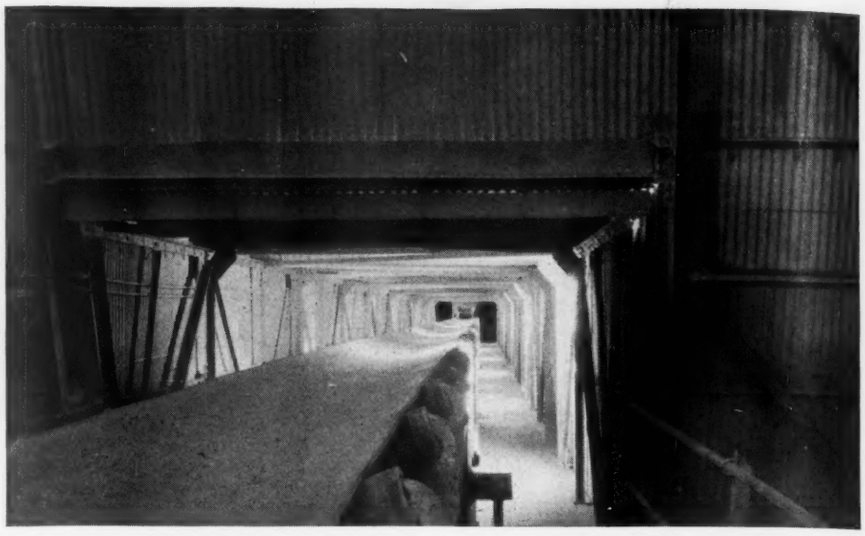


The sizing screens; they are 60-in. by 21 feet long

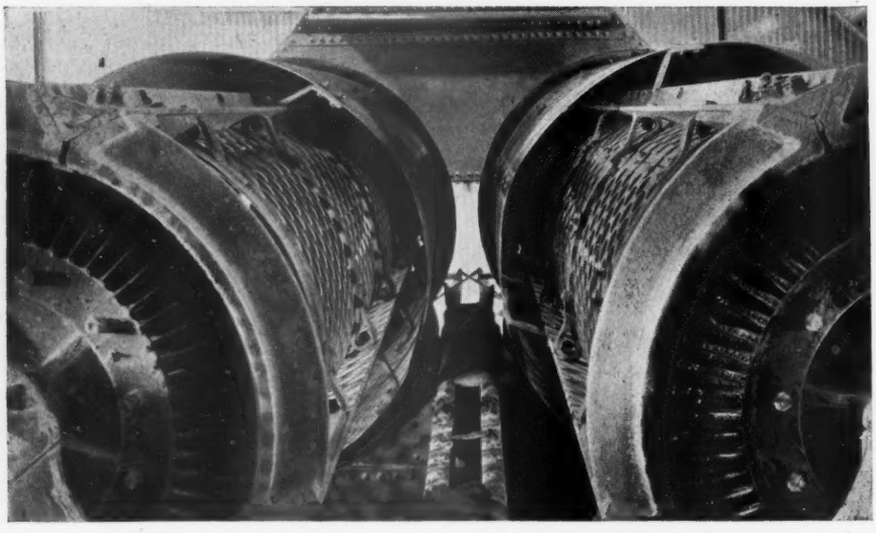
public Rubber Co.) and it measures 273 ft., 6 in. from center to center. It, like the remainder of the conveyor belts, is mounted on Stephens-Adamson "Sacon" carriers and is enclosed in a steel-covered gallery with a run-way on either side of the belt. This belt is driven by a 75-h.p. motor through a Jones speed reducer.

The conveyor discharges into a steel chute which splits the feed to twin scalping screens, 60 in. diameter by 16 ft. long. The drives of these and all other revolving screens in the plant are perhaps the most radically different, yet modern, features of the plant, as compared to the average stone plant. Each screen is individually driven at right angle by a 25-hp. Allis-Chalmers motor (all the motors in the plant are of this make) through a Cleveland Worm and Gear Co. speed reducer, at a 21½ to 1 ratio.

These screen drives, together with similar ones in other parts of the plant and the main conveyor drive are an excellent illustration of the application of mechanical speed reducers in the crushed stone industry; it is highly probable that this example will be followed in many future plants of this kind.



Main conveyor belt which runs from the primary crusher to the scalpers



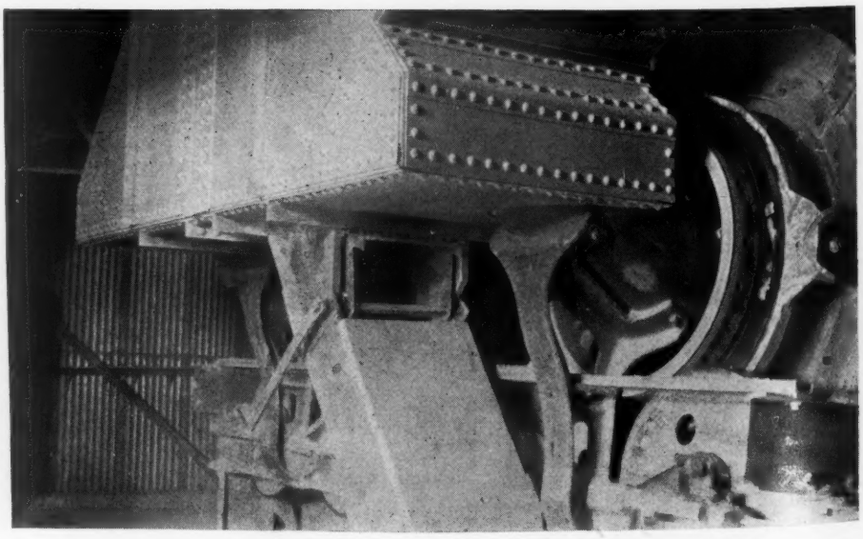
The scalping screens. They are 60 in. x 16 ft.

Rejections from the scalping screens are chuted straight to bins for shipment as furnace stone. Or, if desired, to a No. 8 Allis-Chalmers crusher, if the demand for road stone is heavy and the demand for furnace stone light. The product of the No. 8 gyratory moves by gravity to a 48-in. x 16-ft. scalping screen driven by a 15-h.p. motor through a worm-gear speed reducer, 21½ to 1 ratio. The rejections from this scalper are chuted to a No. 5 Allis-Chalmers gyratory. The output of both the No. 5 and the scalper are conveyed by a 30-in. x 120-ft. conveyor back to the main belt, leading from the No. 21 crusher to the primary scalpers.

The product of the twin scalping screens flows to twin sizing screens, 21 ft. long and 60 in. in diameter. These, like the scalping screens, have right angle drives through worm gear speed reducers of the same size, make and ratio.

Chutes under the sizing screens are arranged to afford any combination of size mixtures desired. The screens themselves are fitted with 10-ft. dust jackets with ¾-in. perforations and the product of these is taken by a 20-in. conveyor of 30-ft. centers to either a Hummer screen or to outside storage. The latter is accomplished by a 20-in. belt conveyor of 180-ft. centers running at right-angles from the plant. It, like the main conveyor, is housed in a steel covered gallery; there is ample room in this outside storage for more than 100,000 tons of screenings.

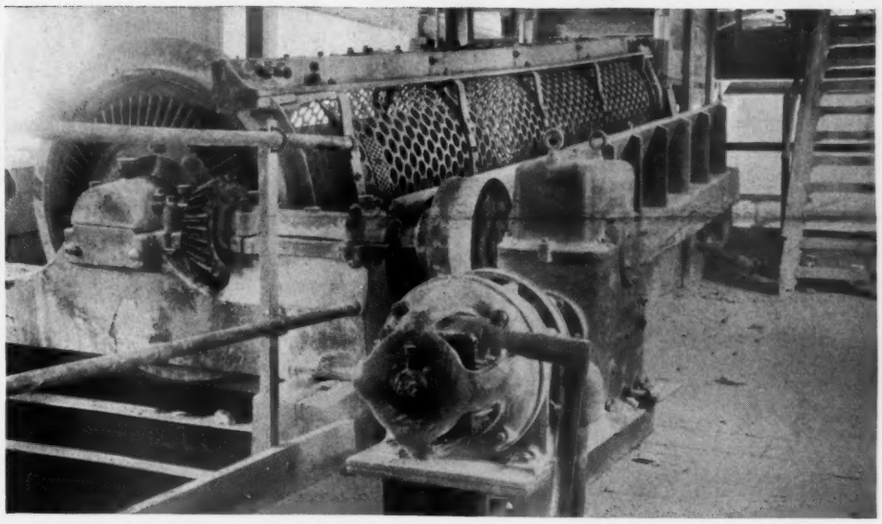
The six 200-ton capacity bins too, are of steel and as may be seen in the picture on the first page of this article, are of catenary design. The success and the adaptability



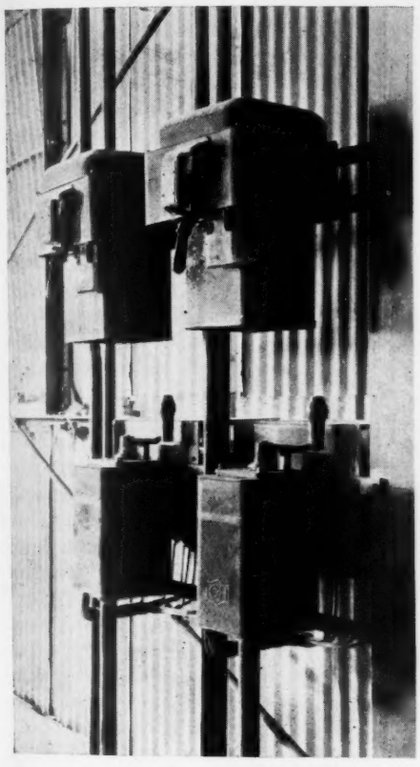
This is the feeding arrangement between the discharge of the main conveyor and the scalping screens

of this type of bin for stone have been practically assured, for after four months of service they show no appreciable signs of wear.

The general design and layout of the plant was furnished by the Allis-Chalmers Manufacturing Co., as well as most of the major equipment. The Bollinger-Andrews Construction Co., Pittsburgh, Pa., designed, fabricated and erected the structural steel. Copper-bearing galvanized sheets furnished by the Republic Iron & Steel Co., Youngstown, Ohio, were used for covering the sides and roofs of the buildings and conveyor galleries. The Dingle-Clark Co., Cleveland, Ohio, had the contract for the electrical work. The plant is wired throughout in conduit, including the 2200-volt lead cable. It is, therefore, the last word in safety.



Secondary scalping screen. Note the right-angle worm gear reduction drive

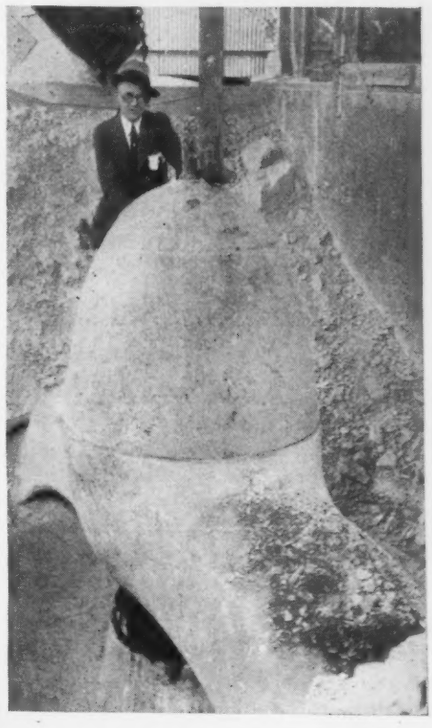


This type of electrical equipment is used throughout the plant. Note the conduit.

This company's quarry is also worthy of description for it also has been modernized in every way possible until now it is not only simple in operation but, like the plant, is beautiful—if such an adjective may be coupled with the word quarry.

The operation is horseshoe shaped and has a working face approximately 3500 ft. long. At present it is being worked in three levels. On the bottom is a 4-ft. layer of "blue" stone, then 9 ft. of "soft gray" and top of this, 7 ft. of "hard gray"; the operation will probably be changed to operate the entire 20 ft. in two levels, however, as there is no longer a demand for either one or the other kind of stone.

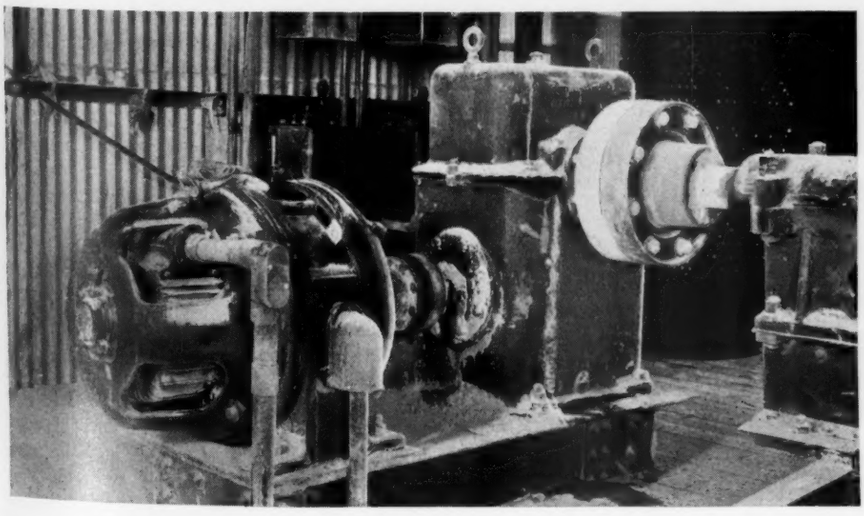
The overburden averages approximately 35 ft. in height. Stripping is done by two Marion steamshovels of the railroad type, one a type 60, the other a type 76, each fitted with 2½-yd. dipper buckets. These are served by trains of 4-yd. Western Wheeled Scraper Co. dump cars hauled by 21-ton Porter steam locomotives.



Looking down into the No. 21 gyratory

Stone is loaded by two model 43 Osgood steam shovels with 1½-yd. dipper buckets. At the present time, however, one of the stripping shovels is operating in stone. The same size and type rolling equipment as used in the stripping is used in the stone handling. In all, the company owns ten locomotives of the type mentioned, but reserves two of them as "spares" for use during heavy runs of the plant.

Drilling is done with Denver drills exclusively. Two "Turbro" models, mounted on derrick carts, do the primary stone drilling, while models 50, 60, and 95 are used for



Close-up of one of the motors and reducers. Note their mounting

block drilling. Air is furnished by two Sullivan angle-compound compressors, of 620 cu. ft. capacity. One is belt driven by a 100-h.p. General Electric squirrel-cage motor while the other is driven by a 150-h.p. General Electric synchronous motor.

The officials and operating staff of the company are as follows: H. W. Heedy,

W. W. Duff, general superintendent

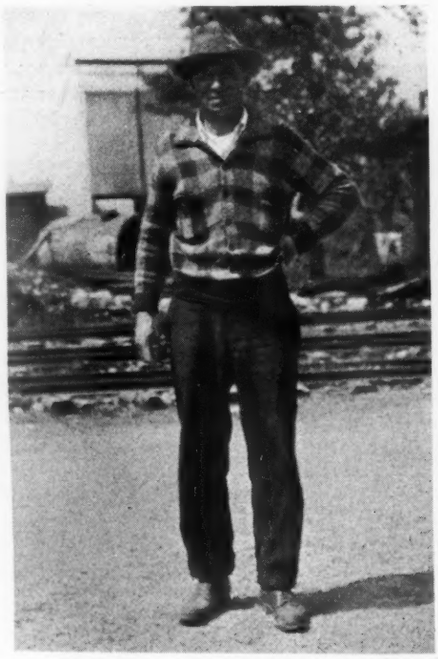
president, Youngstown, Ohio; W. P. Snyder, Jr., vice-president, Pittsburgh, Pa.; W. M. Andrews, secretary and treasurer, Youngstown, Ohio; W. W. Duff, general superintendent, New Castle, Pa.; Paul Durbin, master mechanic and assistant superintendent, Hillsville, Pa., and Michael Rich, quarry superintendent, Hillsville, Pa.

Milling of Fluorspar Ores

THE purpose of an investigation of the methods of milling fluorspar ore, being undertaken by the Bureau of Mines, Department of Commerce, is to determine the best methods and equipment to use, and to obtain data on the principles of ore dressing involved. In the fluorspar district of southern Illinois and Kentucky the ores are largely fluorspar, silica, and calcite, and as these minerals do not differ greatly in specific gravity their milling is a difficult problem. Work conducted by Bureau engineers in this district, extending over a year, has resulted in changes in nearly every mill in the district, The system of jigging unsized material in the Tri-State zinc district has been thoroughly studied, and an effort is being made to apply the information obtained to the milling of fluorspar. It was found that the practice of jigging unsized material, as applied to fluorspar ore and tailings, is not economical, and that good sizing before jigging is essential. The losses of fluorspar in

This derrick cart type drill is becoming popular for use in primary drilling

the tailings were large, in some mills the tailings contained as much as 25 per cent fluorspar. Radical changes in the construction of the jigs used were recommended by the Bureau of Mines engineers, and they assisted in installing changes in the jigs at four large mills that resulted in marked improvement in the work of the jigs. The most difficult problem, however, is to save the fluorspar in the fine material, less than 8 or 10 mesh in size, which in the past has been practically all lost in the tailings. After various experiments, the Bureau engineers with the co-operation of the mill operators developed a system of jigging, classification, tabling and reclassification that treats successfully material as fine as 100 mesh. As a result, one of the largest fluorspar companies in the district is engaged in remodeling its entire mill in accordance with recommendations of the Bureau metallurgists.



Paul Durbin, assistant superintendent

Artificial Rock Aggregate from Fuller's Earth

THE writer has recently had the opportunity to carry on commercial experiments which clearly demonstrate the possibilities for the manufacture of artificial rock aggregate from fuller's earth.

The great Coastal Plain country, extending from New Jersey southwest, forming the eastern border of the Southern states, extends through Texas. This territory has a width of several hundred miles in Georgia and in this Coastal Plain country there are only a few scattered deposits of rock of sufficient crushing strength for use as "rock aggregate."

While it is true that in certain sections of this area large quantities of gravel are now being mined and washed, these deposits are only widely scattered and will before many years be exhausted. While this gravel, which is rounded quartz, makes a satisfactory batch for road-building concrete, yet it is not at all satisfactory for use in concrete in buildings for the reason that it is not fireproof, as it will crack and break the concrete when subjected to heat.

Dr. Grasty has brought out by the analysis of his Louisiana raw materials, which he terms "clay with a fuller's earth base," the reason why his raw materials are so readily amenable to clinkering in the rotary kiln.

It might be rightly wondered by the layman, or even the average technical man, why have not clays been clinkered in the rotary kiln before with success without the addition of other ingredients? It is not because they have not been tried.

Clays are in reality compounds of alumina and silica, while in fuller's earth or decomposed fuller's earth, which have the appearance of clays, the silica is very largely free silica, hydroscopic silica, and where the content of alumina is so small that only a small portion of it, if any, is combined with the silica as an aluminum silicate.

There has been in reality no distinction made between ordinary clays and those materials which have the physical appearance of clays, but which are derived from fuller's earth by the weathering of the earth and which Dr. Grasty has for the first time discussed as "clays with fuller's earth base."

While the ordinary clays have not been found suitable for clinkering for "rock aggregate" without the use of other ingredients, yet fuller's earth and clays with a fuller's earth base clinker readily in the rotary kiln without any difficulty whatever.

As industrial geologist of the Atlanta, Birmingham and Atlantic railroad, the writer is at present making an investigation of these types of raw materials for the artificial preparation of "rock aggregate." I hope in the next few months to have available some very convincing data regarding the commercial application of this type of "rock aggregate" from fuller's earth.—Poole Maynard, Ph. D., in the *Manufacturers Record.*

Pulverized Lime Industry of New England

A Recent Development That Bids Fair to Make Big Changes in Markets for Lime

By Nathan C. Rockwood
Editor-Manager, Rock Products

THE building lime market of New England lime manufacturers has always been largely a market for quick lime—lump lime. These New England limes apparently lose much of their plasticity and sand-carrying capacity when made into commercial hydrated lime. Hydrated, or slaked, on the job some of these New England (even high calcium) limes have long held a notable place in the building trades as finishing limes.

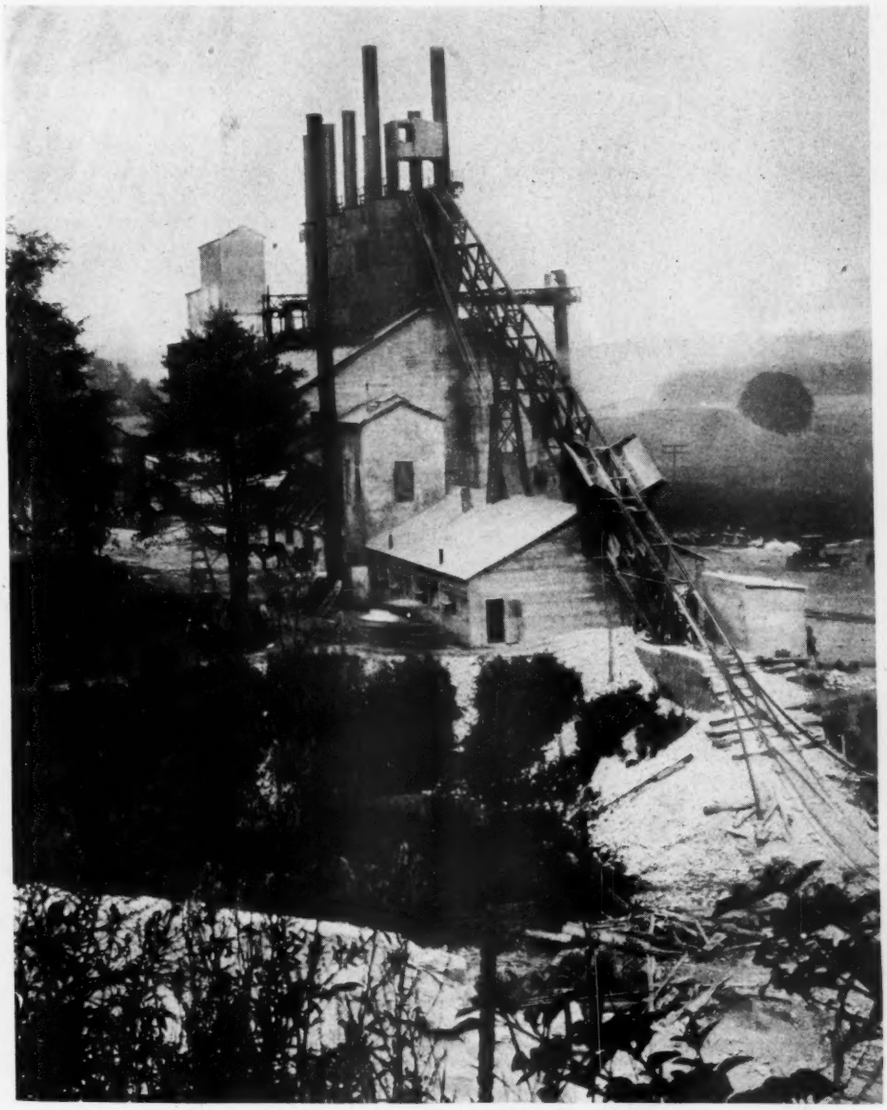
The principal market for New England lime is the New York metropolitan district with its tremendous demand for plaster. The sand-carrying capacity of the New England lines, as well as their accessibility, has long rendered them the dominant factor in supplying this demand.

One of the advantages of prepared hydrated lime, if the hydrating is properly done, is that the lime is thoroughly hydrated; and the big disadvantage of hydrating lime on the job is that the lime is not always thoroughly hydrated and small particles of unhydrated, or quick, lime get into the wall. The result is the well-known phenomena of "popping"—the hydrating and swelling of these unslaked particles of lime in the course of time.

Since the early days of manufacture of hydrated lime in hydrating machines, the necessity, or desirability, of grinding the lime has been recognized. Yet for many years the lime sold to the building trades to be hydrated or slaked on the job has continued to be *lump lime*. That the same advantages of pulverizing the lime before slaking would apply equally well, whether the lime was slaked in a machine at the plant or in a mortar-box on the job, seems to have been largely lost sight of. The demand had always been for lump lime and no attempt was made to change it.

Lump lime was demanded originally on the theory that it would keep better in this form, and also because it was easy to detect old lime, or "air-slaked" lime. Experiments, experience and research have now proved that the granular lime and the pulverized lime have just as good or better keeping qualities, and also that so-called air-slaked lime is not re-carbonated lime, but merely hydrated lime.

Said to be the first pulverized lime on the market

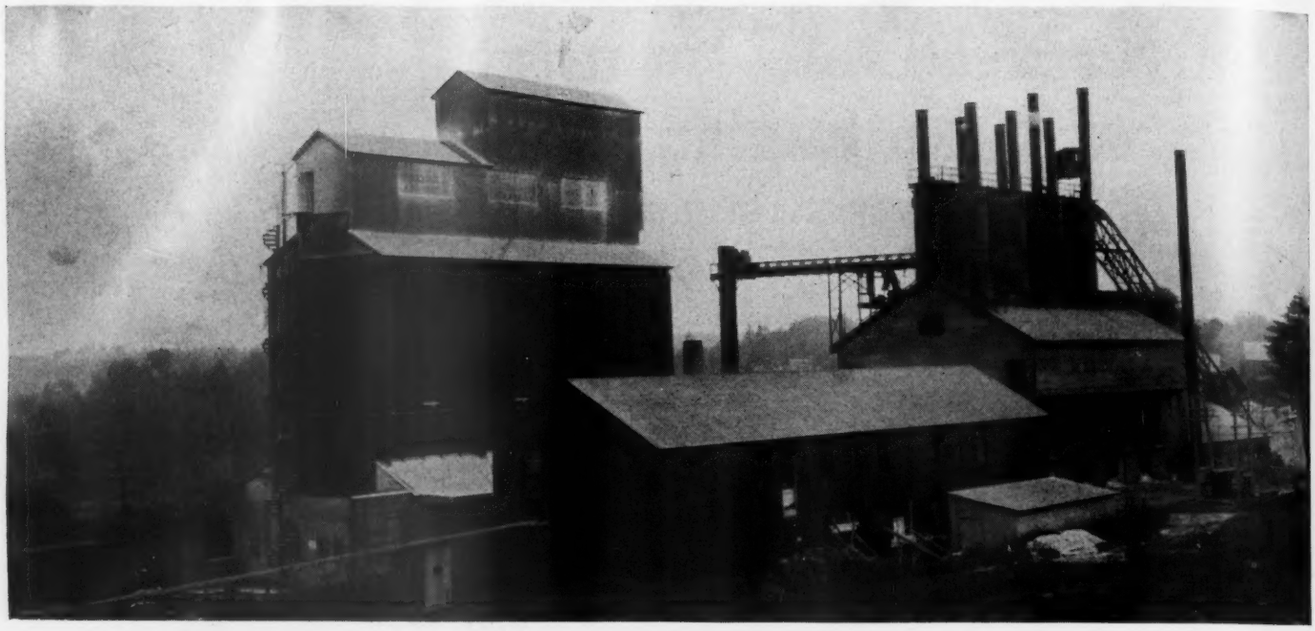


Winooski, Vt., plant of the Champlain Valley Lime Co. as it looks today

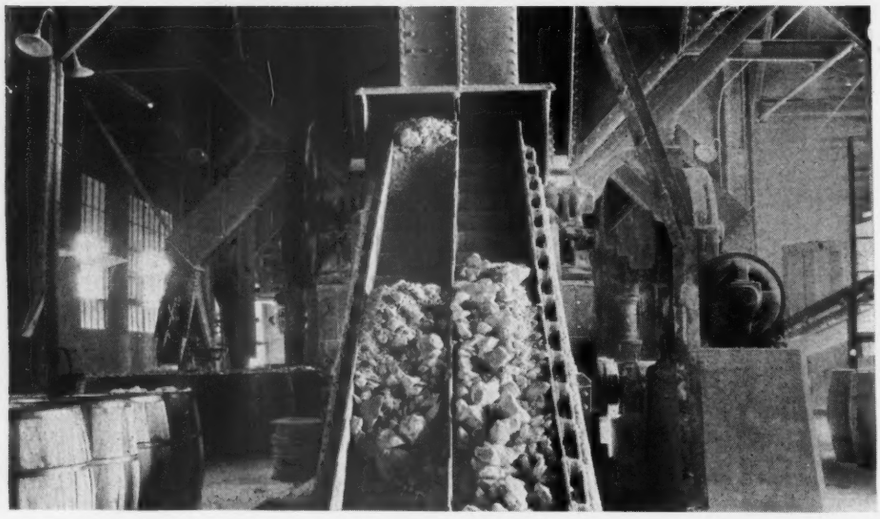
The First Pulverized Lime Plant

According to our understanding Brewer & Co., Worcester, Mass., who operate several lime plants in Vermont, were the first lime manufacturers to apply these findings in a commercial way. At one of the plants of Brewer & Co.—the Champlain Valley Lime Co., Winooski, Vt.—pulverized lime for the building trades has been a specialty for several years. This company early discovered, what was subsequently confirmed by the research work of the National Lime Association, that almost any lime pulverized to 50-mesh was proof against "popping" when incorporated in mortar or plaster.

The old plant of the Champlain Valley Lime Co. at Winooski, under R. W.



Another view of the Winooski plant showing cooperage shop in middle foreground and pulverized-lime plant at left



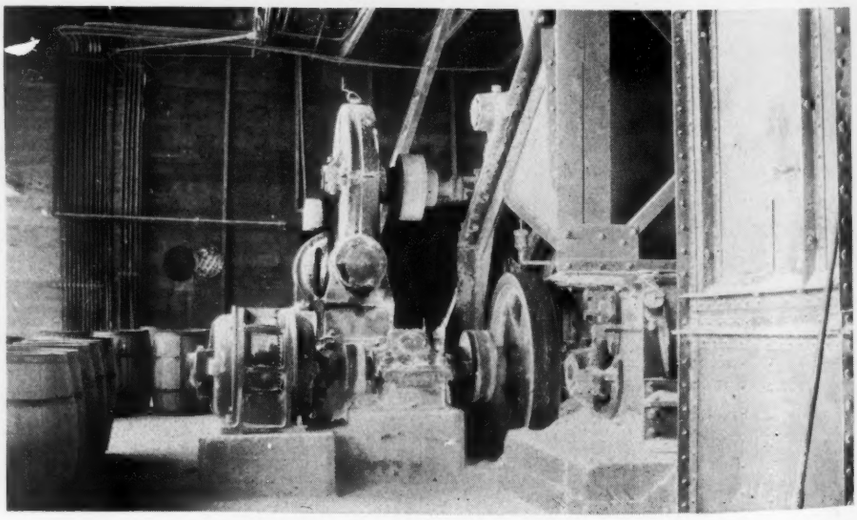
A double-pan conveyor for handling two kinds of lime simultaneously

Foster, manager, had developed a large trade in pulverized lime before the new plant, started in 1924, was conceived. This new plant was designed from start to finish largely to manufacture pulverized lime, and is therefore the first lime plant anywhere to specialize in the production of pulverized lime.

Previous articles in Rock Products (October 4, November 15 and December 27, 1924; December 26, 1925) have described the new plant at Winooski in detail, as the work of its development and construction progressed. The plant is now complete, so far as its pulverized lime manufacture is concerned, and this feature is described in what follows.

During the first week in August, when the plant was visited, the kilns were each producing about 30 tons of lime per day of 24 hours with a percentage of core running up to 10%. These kilns, it may be recalled, are among the largest in the United States, and have produced, when forced, as much as 40-odd tons of lime each in 24 hours. They are coal-fired with automatic stokers. When not forced they produce an excellent quality of lime, said to be the equal, or better, in every way of the wood-burned lime made at the old plant.

But, like the output of every large kiln known to the writer, the lime has to be hand-picked, due, in this case, both to variations in the quality of the stone and to variations in burning. However, this factor of operation, in this particular case, was expected and provided for. The two kinds of lime, that suitable for finishing lime and that which is not, are separated on the draw floor under the kilns and go by a double pan conveyor (Webster) to a double compartment Pennsylvania roll crusher. This fea-



Conveyor (from kiln building) and roll crusher drives

Barrel runway into packing plant

ture of handling and crushing two kinds of lime simultaneously is unique, so far as our knowledge of the industry goes.

The pan conveyor passes under floor of the kiln building and comes up on an incline at the end of the pulverized lime mill room and shipping room nearest the kilns. The conveyor is driven by a 15-hp. induction motor (440-v. 695 r.p.m.) through a flexible coupling and a worm gear speed reducer.

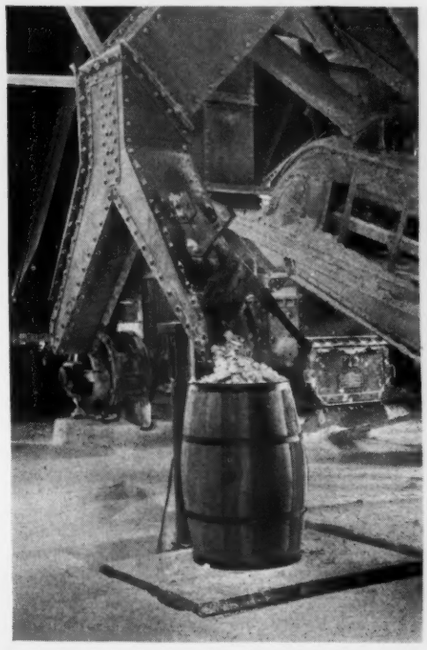
Hammer mill for pulverizing lime

The roll crusher has two compartments, each with 24 x 32-in. rolls, and is driven by a 30-hp., 440-v., 870 r.p.m. induction motor through a spur gear speed reducer.

The discharge of the roll crusher goes to a bucket elevator, also in duplicate, which feeds separate steel storage tanks. From these tanks the crushed lime may be shipped out either in bulk or in barrels, or further processed. When shipping the crushed lime in barrels, the barrels to be filled stand on Howe scales placed with their platforms flush with the floor of the shipping room, and the barrel is quickly filled from a chute in the bottom of the storage bin. For shipping bulk-lime a Manierre box car loader is provided.

Processing Pulverized Lime

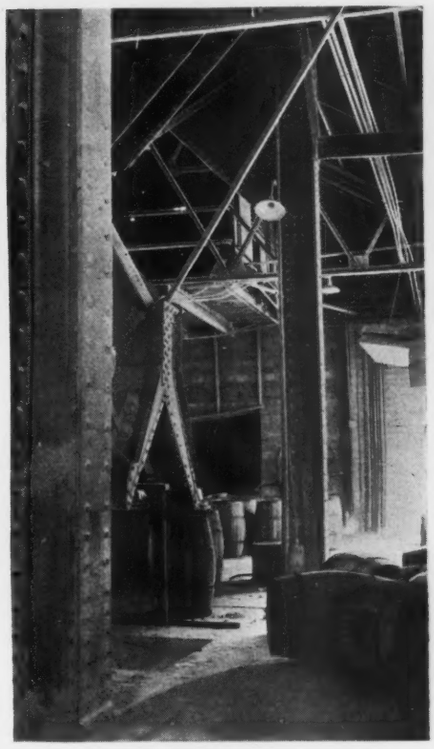
The demand, however, is largely for pulverized lime, and the lime from the roll



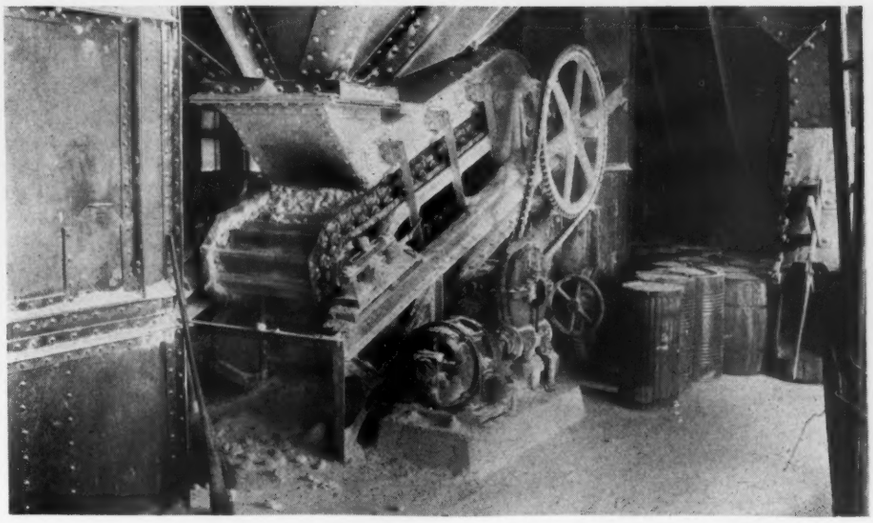
One of the spouts and scales for barreling lump lime

crusher merely passes through the storage bin for further processing. The further processing consists of putting it through a Pennsylvania hammer mill (SXR46) and a battery of two Hum-mer screens in series. reducing the lime so that all will pass 30-mesh. The hammer mill is driven by a direct-connected 75-hp., 440-v., 1160 r.p.m. induction motor, through a flexible coupling. The elevator is driven by a 7½-hp. motor. This mill is fed from a bottom gate in the crushed-lime bin by means of a 30-in. pan conveyor (12-ft. c. to c.) driven by a 5-hp., 440-v., 575-r.p.m. motor through a worm gear reducer and a Link-Belt silent chain drive. A bucket elevator driven by a 5-hp. motor takes away the mill discharge.

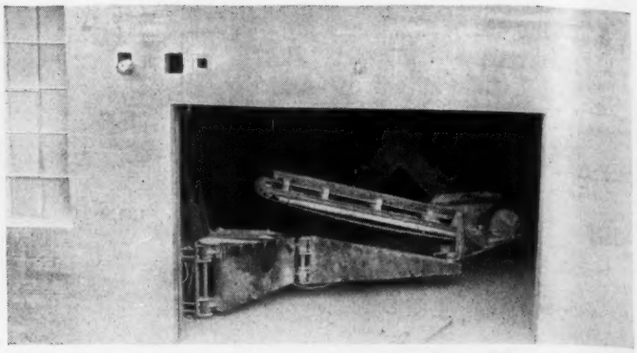
The finished pulverized lime goes to any one of three 500-ton steel tanks or bins. From the bins the pulverized lime is packed into barrels by means of Howe lime-barrel packing machines, each belt-driven by a 5-



Packing room floor—gallery above in the rear has the control switches for the plant



Hammer mill feed (30-in. pan conveyor) and drive



Provision for shipping lump lime in bulk—Winooski lime plant—Another view of bulk lime loader

hp., 440-v. induction motor. The Hum-mer screens are mounted in a room over the bins, and the rejections of the screens are returned to the hammer mill.

All motors and electrical equipment were made by the General Electric Co. and the worm and spur gear speed reducers by the Fawcus Machine Co.

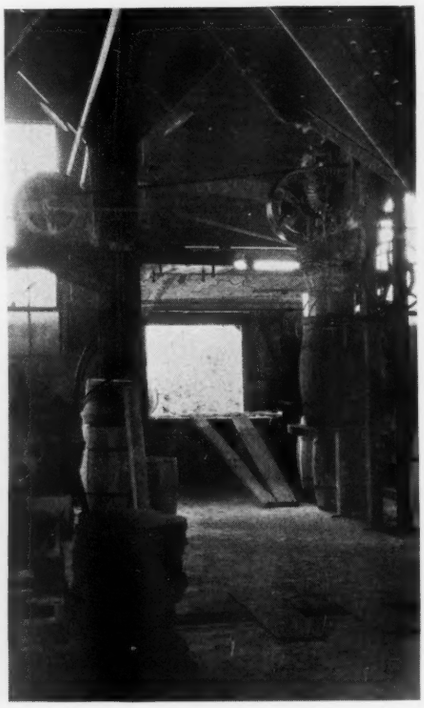
Rockland-Rockport Plant

The views herewith do not do justice to the new pulverized lime plant of the Rockland-Rockport Lime Corp., because the photographs were taken in the midst of construction work.

The pulverized lime plant is distinct from the gas-kiln lime plant, which has received so much publicity. It is several hundred feet east of the gas-kiln plant, and is being built around a battery of older coal-fired (originally wood-fired) kilns. The present wood shipping shed and kiln building were being replaced by a structural steel building when the accompanying views were taken (about the first of August) so that about the only permanent part of the pulverized lime plant illustrated and described herewith are the 500-ton steel tanks.

The plant is so arranged that lime from any of the various Rockland-Rockport plants may be brought there and converted into pulverized lime. This lime is dumped into one of two hoppers which feed a 30-in. single-roll (toothed) Link-Belt crusher. A Williams hammer mill (D-59) driven by a 70-hp., 550-v., 1200-r.p.m. G.-E. motor does the fine grinding. Two double-deck Hum-mer screens in parallel do the screening. All finished material is 50-mesh or finer, and the object is to have as much of it as possible 50-mesh and *not finer;* for there is such a thing as getting it too fine. There are also some problems in screening 50-mesh lime which required extensive research on the part of the Rockland-Rockport Lime Corp. to solve.

Barrel-packing machines at Winooski



Another view of packing room for pulverized lime

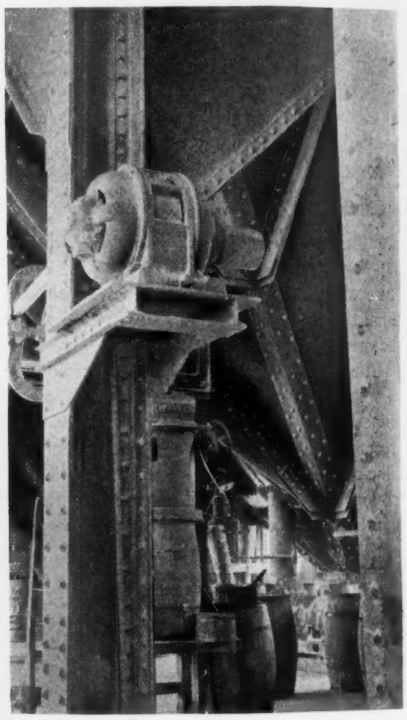
"Failproof Lime"

The Rockland pulverized lime is put out under the copyrighted trademark of "Failproof" lime. It carries a guarantee not to pit. In announcing the new product to the trade a descriptive circular states:

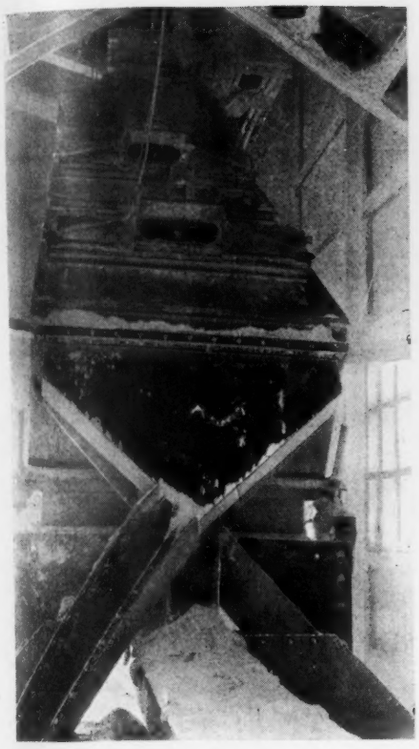
"Long, laborious methods of slaking, aging and mixing lime putty are no longer permitted in these modern times of rush and high labor costs. Lime in the ordinary form if rushed in the mixing is sure to give trouble. Slaking of large quantities, and mixing of hair or fibre use valuable time and space.

"The problem of the lime manufacturer has been to produce a product embodying all the economy of a concentrated material (unslaked quick lime), retaining all the advantages of good lime putty, eliminating the time and expense of preparing the mortar, and, most important of all, eliminating the possibility of pitting or popping in the finished plastered wall.

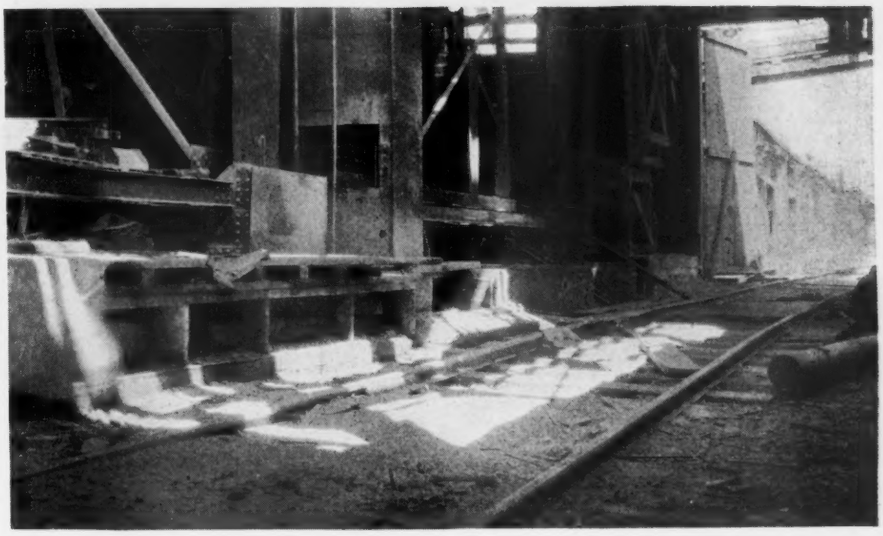
"The process used in manufacturing Failproof lime was developed by the U. S. Bureau of Standards at Washington, D. C., as the result of scientific research for a



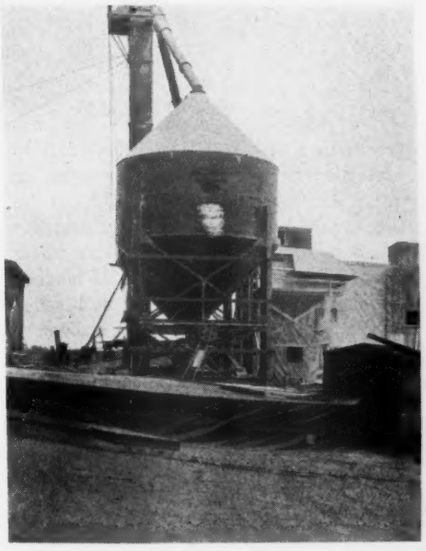
Motor drives on barrel-packing machines



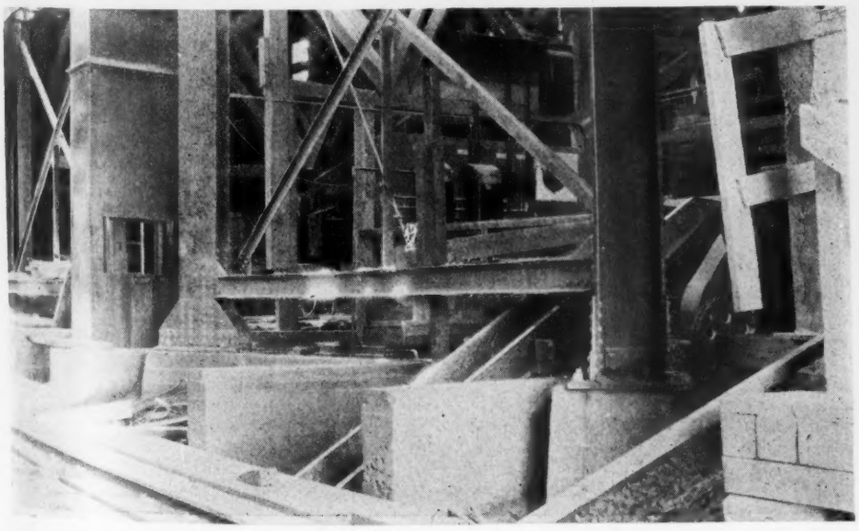
Vibrating screens in series at Winooski pulverized lime plant



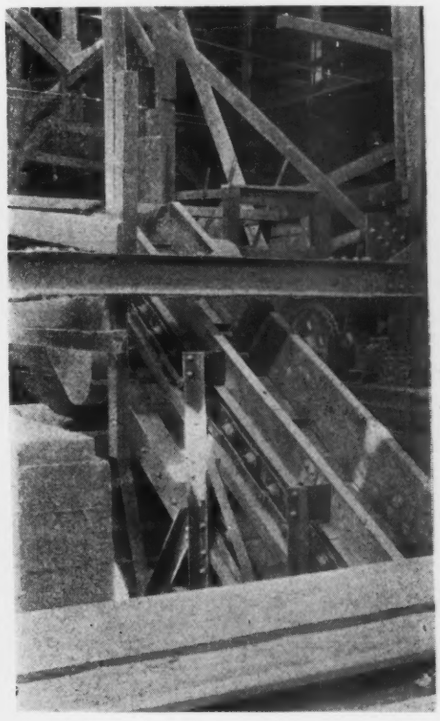
Receiving track and hopper for lump lime at new pulverized lime plant at Rockland



Tanks for pulverized lime at Rockland



Roll crusher and pan conveyor from track hopper at Rockland plant



Another view of lime crusher at Rockland

method to prevent lime plaster from pitting. Considerably more care is used and more money expended in manufacturing our lime than in the manufacture of other quick lime for plastering or masonry.

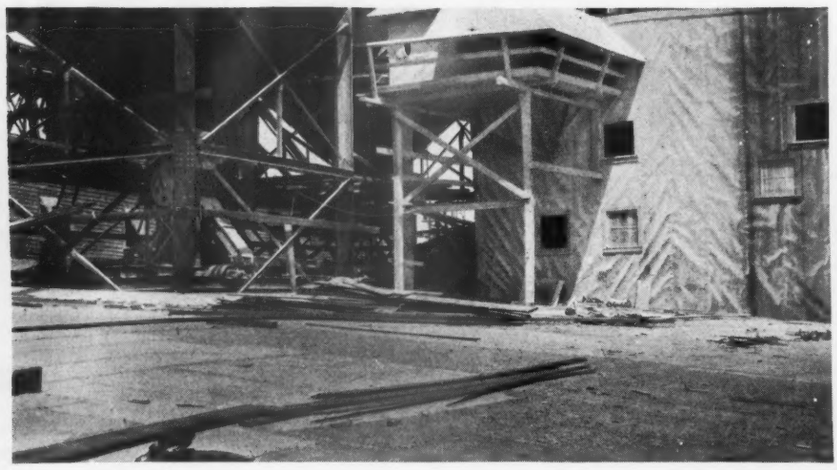
"The quick lime from which our pulverized lime is made is carefully sorted by hand, conveyed to a pulverizing mill and then passed through vibrating screens having 2500 openings to the square inch. This screening process assures uniform fineness and removes all of the material that could in any way produce trouble from pitting.

"The finished product is a fine, pulverized quick lime free of any grit, which slakes faster, yields a larger volume of putty which requires no screen at the mixing box, can be used immediately when cool, and, most important of all, is guaranteed not to pit."

One would expect more difficulty in slaking pulverized lime than is the case with lump lime, on the job. But such is not the fact, if in slaking certain precautions are adhered to. The Rockland-Rockport Lime Corp. gives the following directions for slaking its pulverized lime:

"In slaking pulverized lime *put the water on the lime. DO NOT* put the lime into the water.

"Add the water to the lime gradually until the slaking action is well under way and the mass is warm. Then add more water. Pulverized lime takes lots of water and is hot



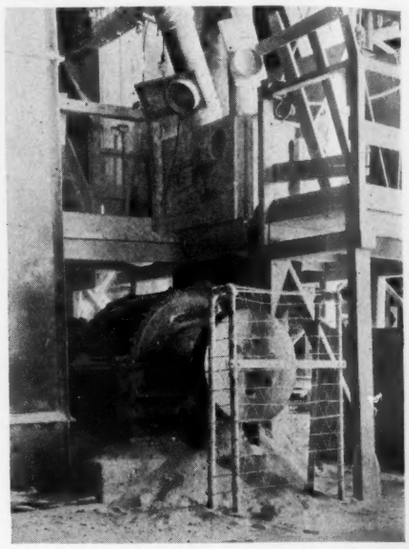
Showing present temporary method of handling pulverized lime at Rockland

slaking. It is necessary to have plenty of water in barrels and a hose with a good pressure of water available for use as required. Do not "drown" the lime by giving it too much water at first, and care must be taken to see that it does not "burn," because of too little water. When the slaking action is under way the mass should be well worked with a hoe so that water will come in contact with all parts of the lime, adding water as needed. Give the putty time to swell or boil after the first and second workings with the hoe.

"In slaking our pulverized lime it is well to have about 4 in. of lime distributed evenly over the bed before the water is added. If the above directions are followed you will obtain at least 11 cu. ft. of putty from one barrel of lime, which is more by a considerable percentage than could be obtained from a similar weight of lump quick lime. There is no core or other foreign matter present in our pulverized lime because it all has been screened out."

Fibred Lime

The Rockland-Rockport Lime Corp. has pioneered in a new field, which bids fair to revolutionize the lime plaster business, if present indications are any clew. This is the marketing of an entirely new product—a fibred lime, to which only sand and water need be added for plaster work. This has been difficult in previous experiments because the animal hair fibre, which is ordinarily used, is destroyed in quick lime. This new product was originally marketed under the trade name "Fibrekote," but George B. Wood, president of the Rockland-Rockport Lime Corp., is too sincere a believer in the virtues of lime plaster to sell it under any camouflage, so it is now marketed under the



Hammer mill for pulverizing lime at Rockland

copyrighted trademark "Failproof" *fibred lime*. Also a patent has been applied for covering the product itself. Describing the new product in its first announcement the company says:

"Carefully selected quick lime is ground to 50-mesh fineness. Each barrel of fibred lime contains the necessary amount of specially

Barrel-packing room for pulverized lime at Rockland plant

prepared, selected quality sisal fibre, thoroughly mixed at the plant with mechanical pickers and mechanical mixing machines.

"The fibre is of a variety uninjured by the slaking lime, in fact the action of boiling in hot slaking lime renders the fibre more pliable, permitting it easily to work through the keys of lathing and properly reinforce the plastered wall.

"Here is a ready-to-use finished material preserving all the advantages and quality of old-fashioned lump lime putty and hair for plastering.

"Figure the saving:

"1. Less labor in slaking.
"2. No screening of putty.
"3. No aging of putty.
"4. Less space required.
"5. No labor preparing hair or fibre.
"6. No labor mixing hair or fibre. Place a portion of the sand in the mixing box, dump in a barrel of "Failproof" fibred lime, give it the water (it needs a plenty, and calls for it quickly). Get busy with the hoe, add the rest of the sand. Hand mix the mortar thoroughly with a hoe, or better yet, shovel it through a machine mortar mixer.

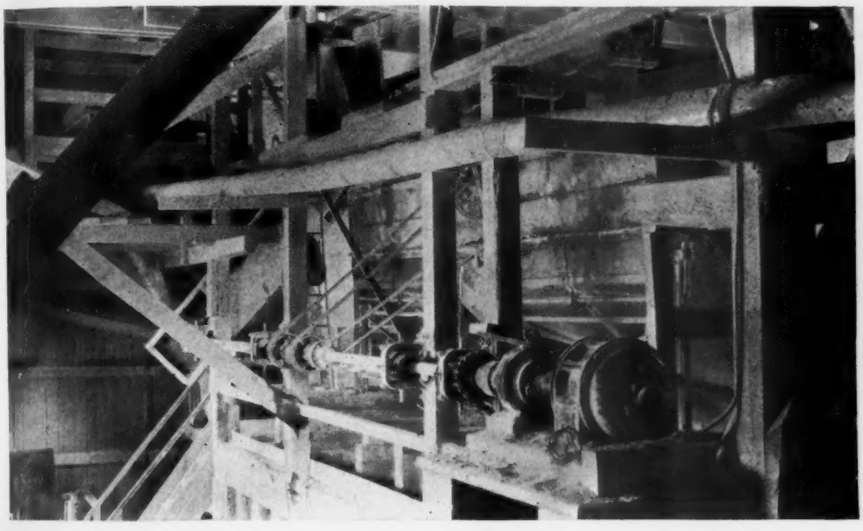
"When the mortar is cool it is ready for the wall and it is guaranteed not to pop or pit."

For picking the sisal a Schofield fibre, or hair, picker is used, and for mixing the lime and fibre in measured proportions a Broughton plaster mixer.

Both new pulverized lime products are packed by Howe barrel-packing machines in tongue and grooved, paper-lined wood barrels (280-lb.) and also in all-steel drums. The company is experimenting with waterproof paper-bag packages containing 90 lb.

The advantages of pulverizing lime to be used in mortar and plaster are more than the mere facilitation of the hydration. In the case of lump lime every partciular lump preserves certain individual characteristics, attributable to slight differences in the limestone itself, as well as to slight—or great—differences in burning. In other words, there is not and cannot be any real uniformity in lump lime.

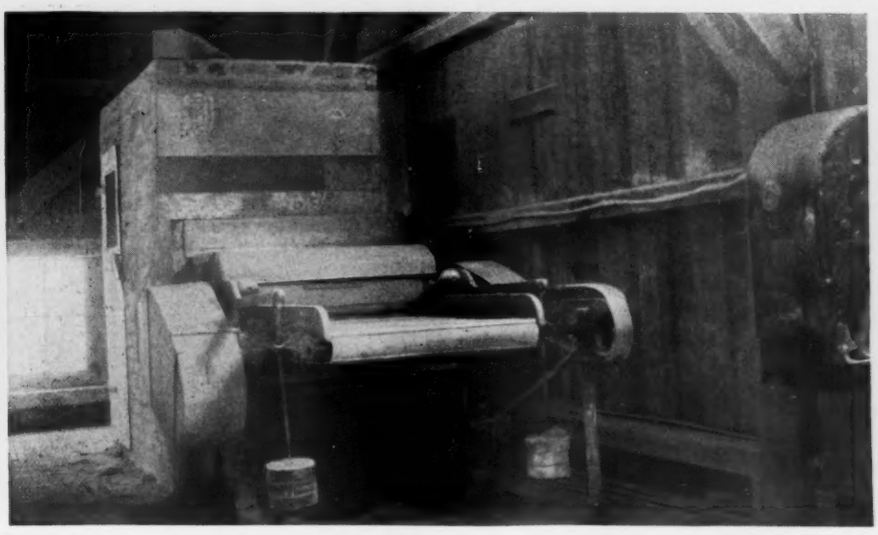
But when the lime is pulverized and passed through vibrating screens and churned in screw conveyors, not only are core and impurities eliminated, but the resulting powder is an intimate mixture of many lumps of lime and therefore the *uniformity* is that of the average lime produced from .he stone



Motor drive on vibrating screen feeds at Rockland plant

Vibrating screens in parallel at Rockland

Barreling fibred lime at Rockland

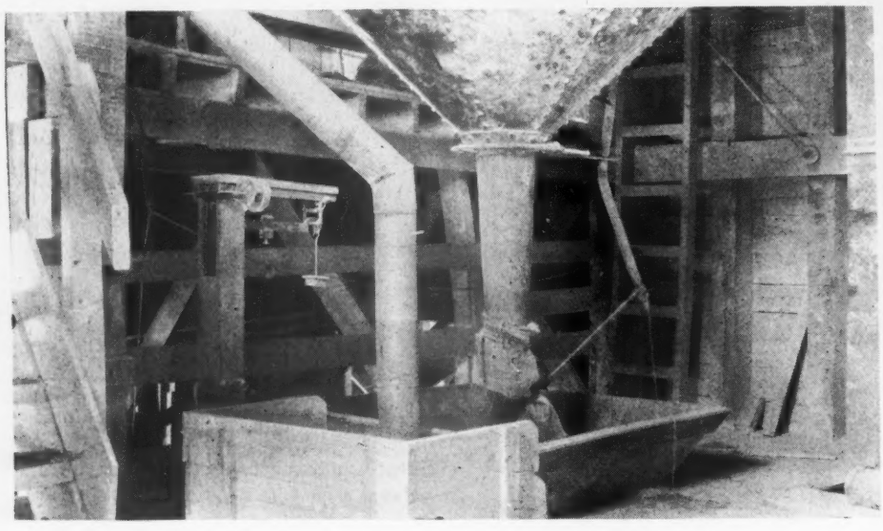


Fibre-picking machine at Rockland plant

burned. It can readily be appreciated that this is an excellent point in favor of pulverized lime, not only for building, but eventually, in all probability, for many other purposes.

Doubtless many improvements will be called for in pulverizing, screening and handling pulverized lime, for it is not an inert powder, but an exceedingly active chemical, presenting special problems in screening that would not at all appear to the uninitiated. It is also very disagreeable stuff to breathe, although we are far from convinced that it is unhealthful. But it will just about make you sneeze your tongue out!

Other Eastern lime manufacturers are becoming more and more interested in pulverized lime, and most of them are ready to admit that it will have an almost revolutionary effect on the building lime markets.



Batcher for lime and fibre at Rockland plant

Absorption of Gases in Milk of Lime

A RECENT article in *Industrial and Engineering Chemistry* by H. G. Weber and K. T. Wilson contains interesting data collected on extensive experiments on the absorption of gases in solution of milk of lime. An apparatus was constructed for determining the conditions governing the absorption of carbon dioxide in various lime solutions under condition of constant temperature.

The experimenters' conclusions follow:

Dry calcium oxide and calcium hydrate absorb a negligible amount of carbon dioxide under the conditions of these experiments.

The addition of 8.8 grams of sodium hydroxide per liter caused a considerable increase in absorption rate at the highest rate of stirring.

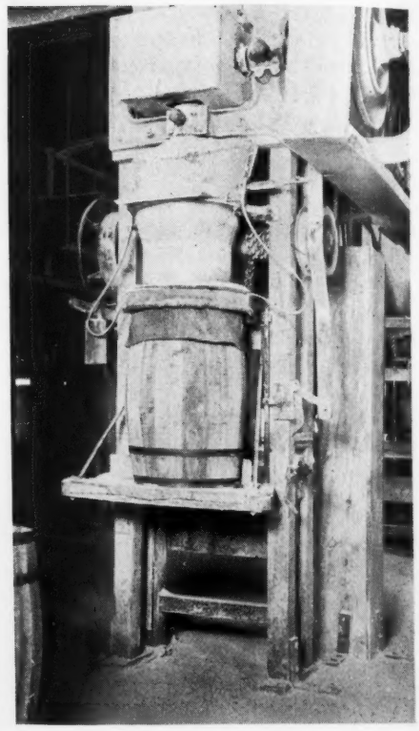
The rate of absorption was found to be practically constant over the range studied using 10 grams of lime. Using 0.5 gram of lime, the rate was found to be proportional to the distance from saturation.

The rate of absorption using 0.5 gram of lime was found to vary with the rate of stirring but at a rate somewhat less than the first power.

The multiple-film theory of absorption appears to offer a satisfactory explanation for the results obtained.

Minnesota to Survey Marl Deposits

THE full extent of the possibilities of making portland cement from Minnesota's extensive deposits of marl in bogs and lake bottoms will soon be known. The Minnesota Geological Survey is carrying on a careful survey of marl deposits in central and northern Minnesota under the direction of Professor George A. Thiel, University of Minnesota. Mr. Thiel was assigned the work by Dr. W. H. Emmons, director of the survey and head of the university's department of geology. The report is expected to disclose even more marl in Minnesota than anticipated.



Barrel packer at Rockland plant

Together with this survey the university has just issued from its engineering experiment station a revised edition of bulletin No. 4, "The Manufacture of Portland Cement from Marl," by Professor R. E. Kirk. The first edition of this bulletin was published in 1923 after the investigation had been made.

The bulletin, a 98-page booklet discusses the methods of making cement from marl, successful ventures elsewhere in that field, the conditions that must be found to make cement manufacture from marl successful in Minnesota and gives a survey of Minnesota marl deposits that were known prior to the more thorough study which the geological survey is now carrying on.—*Sauk Rapids (Minn.) Sentinel.*

The finished product at Rockland—name coyprighted and patent applied for

Modern Methods and Processes of Mining and Refining Gypsum*

Part XI.—Structural Gypsum Products—Partition Tile

By Alva Warren Tyler

OF the quantity of calcined gypsum diverted to products manufacture, by far the greater portion is used in the production of partition tile, the demand for which, since its first introduction, has grown until the required annual output at the present time runs into millions of square feet. As a fireproof non-bearing partition material gypsum partition tile enjoys the distinction of being the only such material meeting the required fire tests and approval of the Underwriters Laboratories of the National Board of Fire Underwriters. This approval is largely due to their qualities as non-conductors of heat, they having 40% greater resistance to heat conduction than other materials usable for a similar purpose. In addition to these essential qualities required in fireproof construction, gypsum partition tile are 60% more effective as non-conductors of sound than other recognized partition materials. The light weight of gypsum tile has already been referred to. The following table will serve as an illustration of this characteristic. The figures given are the results of recent tests of standard grades and sizes of both gypsum and terra cotta tile.

Tile thickness	Weight per sq. ft. (lb.) Gypsum tile	Clay tile
3 in. hollow	8.75	18
4 in. hollow	9.88	22
6 in. hollow	17.45	25
8 in. hollow	19.76	{ 40 (6 cell) { 28 (3 cell)

Masonry of common brick weighs about 100 lb. per cu. ft. and concrete about 150 lb. per cu. ft.

The mixture used in the manufacture of gypsum partition tile is much less dense than that for either filler or roof tile, being composed of first settle stucco, about 3% of wood fibre and a very small percentage of accelerator, depending on the normal setting time of the stucco. Accelerator is most commonly prepared by grinding discarded pieces of broken tile. Ground anhydrite is a particularly good accelerator, as is also potassium sulphate. From 0.5 to 2% of accelerator is often used to increase production. Too much accelerator, however, should be avoided as otherwise weak tile will result. Excelsior chopped to about ¾-in. lengths is often substituted for the wood fibre and makes a very strong tile. Sawdust is also frequently used but it adds nothing to the strength of the tile and acts chiefly as a filler, decreasing to some extent the brittleness of the tile. Water is added to give a light, creamy consistency, the amount of water required for this freely pouring mixture being approximately 45% by weight and calcined stucco 55%. The proportions of fibre and water may vary slightly with the quality of stucco used, a rich, finely ground stucco requiring more water than a short, coarse product. In any case, to meet the specifications of the American Society for Testing Materials and the Underwriters' Laboratories with regard to weight, strength, etc., ot may be found necessary to make some slight modfiications in the mixture.

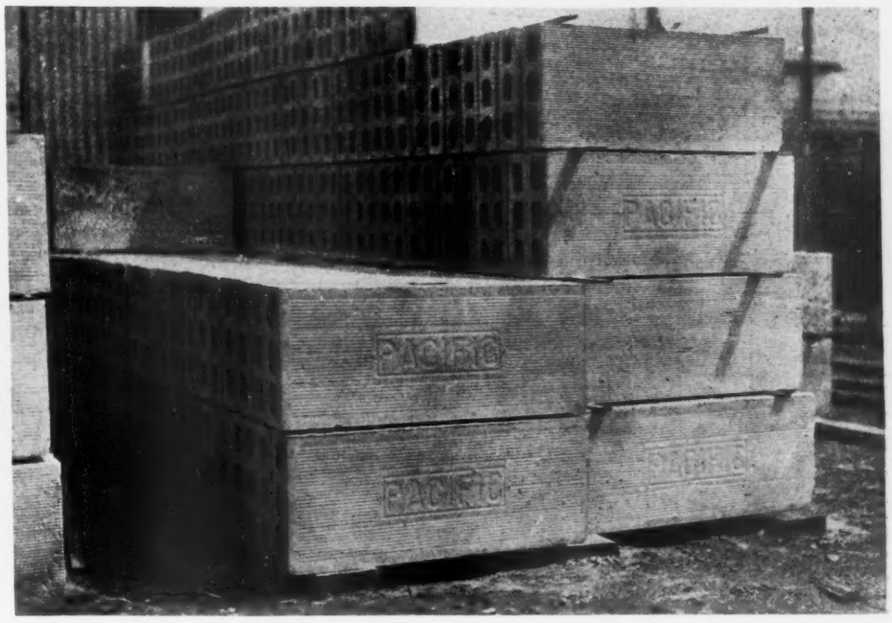


Fig. 2—One type of gypsum partition tile

*Copyright, 1926, by Alva Warren Tyler.

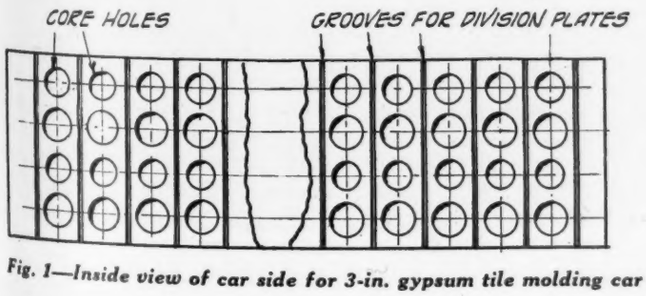


Fig. 1—Inside view of car side for 3-in. gypsum tile molding car

First Made by Hand

Gypsum partition tile are the oldest of the gypsum tile products and were first made by hand, that is, poured by hand into rather crudely built molds laid flatwise. They were first cast solid, but it was soon demonstrated that they could be cored to advantage and still retain their necessary strength. Hand molds were quickly discarded for the car molding system, which seemed to be a great improvement. This system was rather elaborately developed for quantity production and was quickly adopted by most of the larger gypsum companies. In this system the tile were cast on edge, the molds being built in multiple on a small car operated on a track. The deck of the car was a flat steel plate, on top of which was assembled the molds, which were made up of so-called "car sides," "division plates," and "core poles." The length of the molds ran crosswise of the cars, the "car sides" forming the ends of the molds and the "division plates" the sides.

The "core poles" were usually of round cross-section and turned from hard maple. Rectangular cross-section cores were designed and tried but were discarded as impractical. Holes were machined (usually bored) in the car sides on the center line of each mold position and into these holes were inserted the core poles when the molds were assembled. The core poles were tapered to facilitate removal after the tile were set, necessitating opposite holes in the car sides to be bored to conform to this taper. The car sides were originally made of cast iron, but due to excessive breakage they were later replaced by steel. The inner faces of the car sides were machined to give a true surface and grooves were cut cross-wise (vertical when assembled) of the sides at regular intervals to receive and hold the division plates. The spacing of the grooves, of course, depended on the size tile for which the molds were designed, the spacing between adjacent edges of two successive grooves being the thickness of the tile. In order to make the coring of the tile uniform, it was necessary to make the car sides in pairs so that half of the cores could be inserted from one side and half from the other. The division plates were also made of cast iron and were usually grooved or corrugated in order to produce a tile more easily plastered on. In the center of one side of the plate was usually placed the manufacturer's trade-mark.

In the early days of gypsum partition tile manufacture there were but two sizes of importance—those of 3 in. and 4 in. thickness (face dimensions 12x30 in.) the demand for the 3 in. size predominating, and therefore there was but little equipment provided for other sizes. Figs. 1, 3 and 4 are sketches showing details and assembly of a multiple car mold for 3 in. tile. Molds for 4-in. tile are similar except that but three cores are used for the 4-in. size. In assembling the molds the car sides were first set up on the cars, then the division plates slipped in place and the sides clamped together with clamps. The core poles were then slipped into place and the mold was ready to pour.

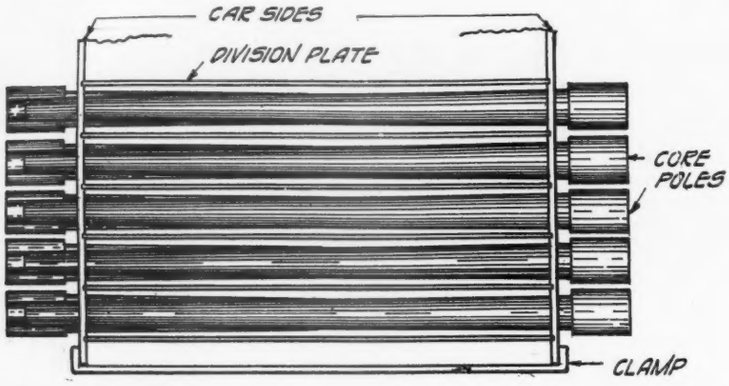


Fig. 3—Partial plan view of assembled car for molding gypsum tile

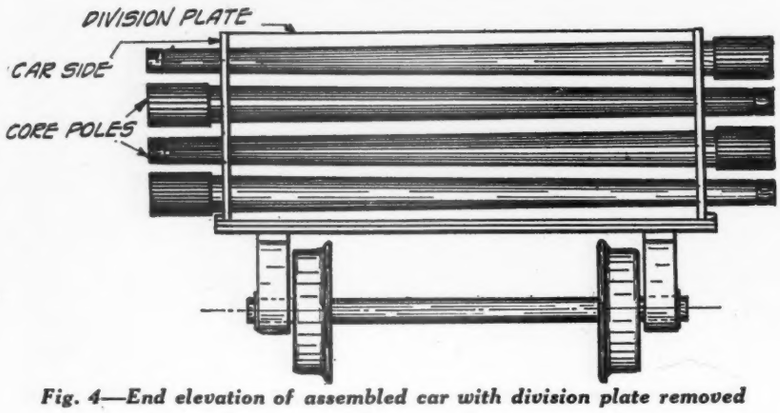


Fig. 4—End elevation of assembled car with division plate removed

In operation a power mixer or pugmill was used for preparing the gypsum mixture. This was set at sufficient height so the molding cars, running on a track directly below, could be easily filled merely by pulling a lever which opened the discharge gate from the mixer. A sufficient number of cars were necessary to allow time for the gypsum to fully set, the removal of the cores, the breaking down of the molds and removal of the tile, the cleaning and reassembling of the molds and returning to the mixer again—in order to keep up a reasonably continuous operation. The plant capacity was therefore dependent upon the two factors of mixing capacity and number of molding cars, assuming other plant conditions to be proportional.

Removal of Cores

After the gypsum was set the next operation—the removal of the cores—was an interesting one. This was accomplished by means of sledge hammers in the hands of laborers, one sledging from each side of a car. The cores, although tapered, adhered tenaciously to the set gypsum and it often took two or more blows of the sledge to dislodge a core. In fact, the small end of the core, which usually projected through the mold several inches, was frequently broken off instead of being driven out, and unless there was sufficient stock left to admit of further turning the core was scrapped. Experienced core drivers, however, became quite expert at dislodging the cores at one blow and often the cores, suddenly released, were projected across the floor for a distance of several feet. Thus cores were strewn over the floor on each side of the car for some distance. These had to be gathered up at opportune times, cleaned and replaced in the storage racks or reassembled cars.

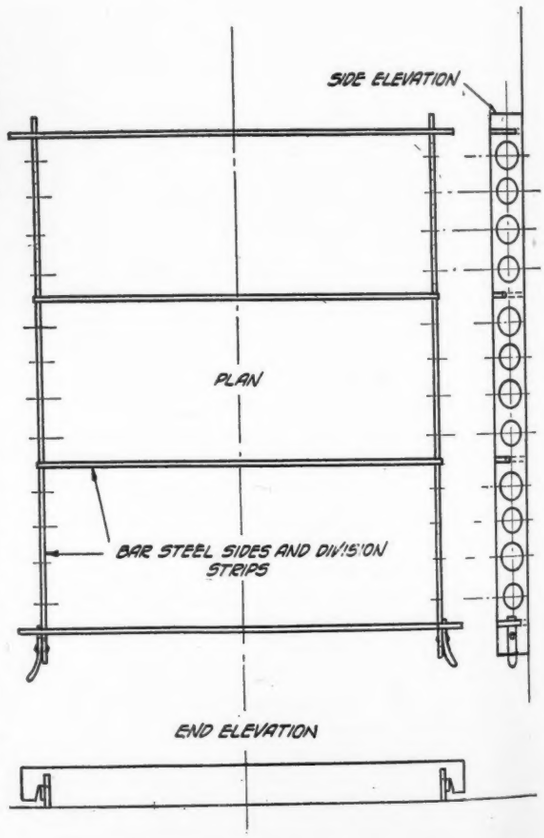


Fig. 5—Typical steel mold for molding 3-in. partition tile by hand

The breaking down of the molds was simple, the clamps being knocked off, thus releasing the car sides, which in turn released the division plates. A slight blow then separated the plates from the tile, the latter being removed and placed on kiln cars for drying.

Cleaning and reassembling the molds was important and laborious. Often the car sides

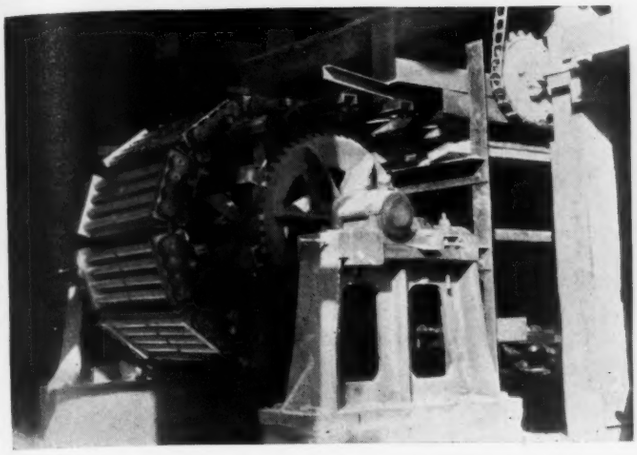


Fig. 6.—Feed end of automatic tile machine using aluminum half-cores meeting in the center of the mold

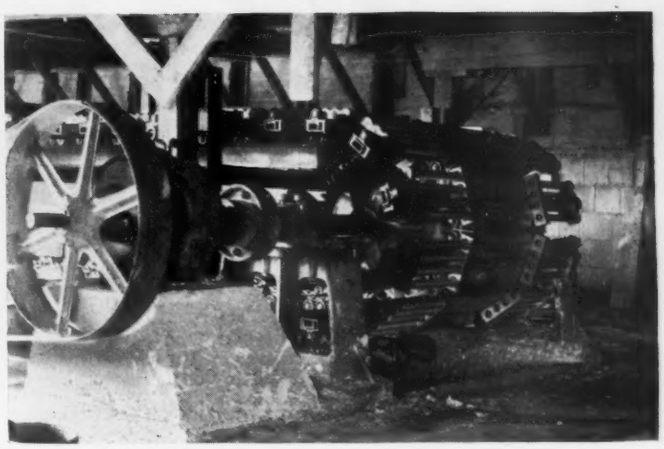


Fig. 7—Discharge end of same machine, showing half-cores fully withdrawn from molds

and division plates became coated with a thin layer of gypsum, which if allowed to remain would promptly corrode the parts and increase the tendency for the mixture to still further stick and corrode. This was largely eliminated by oiling the parts with light oil, although this was but partially effective on the corrugated division plates, these frequently having to be still further treated by brushing with a wire brush, usually a rotary power brush. The wooden cores also had to be cleaned, lightly oiled and returned to the molds. After cleaning came the reassembly, which, while a simple operation occupied consideration time, as each car side, division plate and core pole had to be handled separately and placed in its proper position.

While the car molding system was capable of development into large capacities it proved very expensive, requiring an enormous amount of labor to handle the various operations, besides much costly equipment. Equipment replacements also proved to be an expensive item, the annual breakage in division plates and core poles alone running into almost prohibitive costs.

Many attempts were made at improvement of this system, some of which were the building of special machines for pushing out core poles; the substitution of metal cores for the wooden ones; the use of interlocking permanently mounted molds which were semi-automatic in their ejection of the blocks; the use of vertical glass cores, etc. However, the labor item remained prohibitive and it very soon became apparent to the large operators that more efficient methods must be devised.

First Automatic Machine

In 1912 one of the large gypsum concerns developed the first automatic gypsum tile molding machine used in the United States. During the period of this development many operators returned to the hand molds. This hand molding method required but simple, cheap equipment, with very few repairs or replacements, and by the organization of a piece-work system a highly efficient operation was developed. The molds themselves were of greatly improved form over the original hand molds, being made in multiple, of steel frame-work and so designed that they could be very rapidly taken down or set up with little effort. (See Fig. 5.) The tile were cast flatwise as originally, three tile per mold, on a specially designed rubber mat to give the tile the usual face corrugations and trade-mark. The top faces of the tile were usually scored by hand when partially set, using a piece of garden rake or specially designed scoring tool for the purpose. These hand molds were worked on tables, two to each table. Each operator worked three tables, pouring the molds in regular order. This number gave the operator just enough time to break down a mold, remove the tile, reassemble and pour while the tile in the next succeeding mold was setting sufficiently to be removed. To eliminate the necessity of driving out the cores as in the car system, a hole was bored in the head of each core, so that when the gypsum mixture was sufficiently set to hold its form a pin was inserted into this hole and the core given a slight twist, breaking the adhesion between the core and the plaster. Thus when the tile were fully set the cores could be easily removed without effort.

Under regular operation of the hand molding system, as finally developed to efficiency, one molder could produce and place on the kiln cars in 8 hr. 853 sq. ft. of 2 in. solid tile, 667 sq. ft. of 3 in. hollow, 540 sq. ft. of 4 in. hollow and 450 sq. ft. of 6 in. hollow tile at a cost closely rivaling that of present machine methods.

The difficulty with the hand molding system, however, is that tile production is always more or less erratic, due to seasonal demand, making it hard to keep the operating organization intact and working efficiently.

The hand molding operation, although developed to a comparatively high efficiency and having the further advantages of economy in first cost, and flexibility, was really but an expedient pending the outcome of the trial of the new automatic equipment.

The automatic gypsum tile molding machine referred to above proved a practical success. It was built on the principle of the ordinary pan conveyor, the tile molds lying flat-wise and taking the place of the pans of the conveyor. The ends of the molds were of castings machined to receive the cores which were still of wood and had to be removed and replaced by hand. The difficulty of adhesion of the cores was overcome the same as in the hand molding method referred to above, the twisting operation, however, being automatic. The end of the molds were hinged, so that after the cores were removed these ends were automatically opened

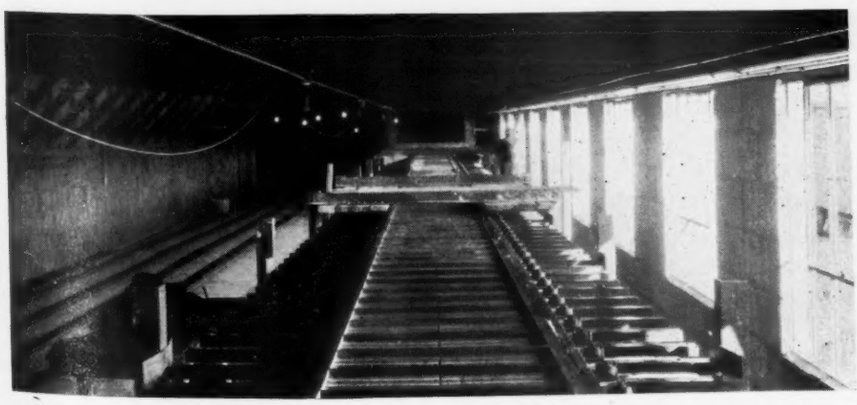


Fig. 8—Intermediate section of same machine shown in Figs. 6 and 7. The point where the half-cores meet at the center is clearly shown

outwardly, freeing themselves from the ends of the set-up tile. The division strips, being only the thickness of the tile in width, were easily separated from the latter as they moved over the circumference of the specially designed sprocket at the discharge end of the machine. The tile were discharged automatically, and although there was some difficulty with this operation at first, it was finally successfully perfected.

To Determine Size of Machine

Since the setting time of a given stucco is practically uniform, it will be noted that with this style of machine its capacity is limited only by its length. The necessary length between the pont where the molds are poured and the point of discharge is the product of setting time and speed in feet per minute. The capacity is dependent on the speed. Once the capacity is known, therefore, the length is easily determined. These relations may be expressed in practical formulae as follows:

Let S = Setting time of stucco in minutes.
T = Capacity in tile per minute.
c = Constant depending on the width of molds.
F = Speed of molds in feet per minute.
L = Length of machine in feet (pouring point to discharge point).
A = Additional length in feet required for preparation of molds before pouring.

Then, $L = SF + A$; and $T = Fc$. Therefore, $L = \frac{ST}{c} + A$.

When the width of the tile is 12 in. (as is usually the case) and
t = Thickness of the division strips in inches.
Then,

$$c = \frac{12}{12 + t}.$$

Assuming t = ¼ in., c = .9795, or roughly, T = F, for estimating purposes. The additional length A will depend on the particular requirements in each case and may vary under ordinary circumstances from 5 to 15 ft.

It will be seen from the above relations that any decrease in setting time by acceleration will correspondingly decrease the required length of machine for a given capacity or conversely will increase the capacity for a given length, and therefore acceleration within the limits of practicability is very desirable.

Since the advent of the gypsum tile machine described above much progress in automatic tile production has been realized. A number of other machines built on this same principle have been devised, with important improvements. One design (See Figs. 6, 7, 8) uses automatically operated aluminum cores, and instead of these cores being in a single length extending through the mold, as was the case with the old wooden cores, they are but half-cores, meeting and engaging each other at the center of the mold. For each mold therefore there are two sets of half-cores, each set being mounted on a core head sliding in a guide on either side of the mold. The cores are all of the same size and taper uniformly from the outside to center. It will be noted the particular advantage of this design is the automatic operation of the cores, which in turn is made possible chiefly by virtue of the fact that it is necessary to move them but half the length of the tile in order to accomplished their complete clearance or reassembly. Another feature incorporaated in this design, and really made necessary by the automatically operated cores, is the stationary mold end which are tapered slightly to allow ejection of the tile. The bottom plate of each mold is in sections hinged together so that in going over the discharge pulley these sectionss gradually free themselves from the tile, allowing the latter to drop from the mold.

(To be continued)

Some Principles of Advertising Building Materials

AT a meeting of the Finger Lakes Building Material Dealers Association held in Ithaca, N. Y., recently, Howard Rhode, advertising manager of the International Cement Corp. delivered an address which gave some important fundamental principles of the advertising of building materials, especially cement. Mr. Rhode said in part:

"In advertising building materials the task divides into three very definite and distinct phases. These all blend together into one main task but each has its peculiarities.

"1. The first and perhaps the fundamental job of the manufacturer is to acquaint the consumer with his product, to convince the consumer of its quality, to create confidence. Only by creating a full measure of confidence can the manufacturer fulfill his obligations to the dealer who handles his product. For it is this confidence which lessens for the dealer the sales resistance to be overcome in making the sale. Confidence is the indispensable factor in selling, and to get an active confidence for his product is the manufacturer's primary responsibility.

"2. Next comes what might be termed educational advertising. The best product ever turned out of a mill can be ruined by inefficient use. The manufacturer *cannot* take it for granted that the public will use his product efficiently. He must see to it that they do. That is why educational advertising is absolutely necessary. It is obviously up to the manufacturer to initiate this so-called educational advertising. But he should be able to count on the enthusiastic co-operation of the dealer. In most cases that co-operation is readily forthcoming, for it is in the dealer's own best interests as well as those of the manufacturer that the product shall be used properly.

"3. The third phase of the joint advertising problem of manufacturer and the building material dealer is what is best termed promotional advertising. By developing and maintaining public confidence in his product, by adherence to high quality standards and by educating the consumer in its use the manufacturer furnishes the background for this third phase of advertising—the promotional effort."

Mr. Rhode explained that the product is its own best advertisement because:

"The quality of the product must of necessity shoulder the lion's share of the job of keeping itself sold, and quality is the manufacturer's primary responsibility. Thus, in a very real sense advertising begins and ends with the quality of the product itself. A keen realization of this fact explains the unceasing effort of cement manufacturers to advance cement quality and the standards which measure that quality. That is why we test Lone Star cement from the raw material deposits every step of the way through the 80 or more distinct operations of manufacturing, right up to the time the finished cement is loaded onto the car and that is why we issue a written guarantee of quality.

"Instead of waiting for the public to demand higher standards, the manufacturers have of their own volition consistently advanced standards just as far and as fast as scientific progress made possible."

Expansion of Gypsum

WHEN calcined gypsum is mixed with water in the usual manner it becomes hard or sets. This setting process is usually accompanied by a change in volume which may be either an expansion or a contraction, but is usually the former. This property is important in making gypsum casts, as it causes the material to fill the crevices of the mold, resulting in clean-cut castings. Furthermore, expansion plays an important part in the adhesion of gypsum plasters to certain backings. It is well known that gypsum plaster having a minimum expansion on setting has a maximum adhesion to concrete. It is desirable to control the expansion in such cases, and consequently a study of the factors affecting this property of calcined gypsum has recently been undertaken at the bureau. The material to be measured is cast in specimens approximately 13x1x1 in., and the linear changes on setting are followed by means of a microscopic comparator.

A series of specimens made from normally calcined gypsum mixed with varying amounts of water has been made and the resulting expansions measured. These results show that the expansion varies inversely with the amount of mixing water. Samples mixed with 47.5% water gave an average linear expansion of 0.173%, while those mixed with 55.0% water expanded 0.096%, with intermediate mixes in proportion. Further work in which the fineness of the gypsum, time of set, and method of calcination are varied is in progress.—*Technical News Bulletin* of the U. S. Bureau of Standards.

German Portland Cement Makers Meeting

Research Men Discuss Aluminous Cement and the Manufacture and Testing of Portland Cements

AT a meeting of the German Association of Portland Cement Manufacturers, held in Hanover, September 8 to 10, 1926, a number of papers were presented on general subjects connected with cement making and testing. These will therefore be interesting to American readers and abstracts follow.

FUSED ALUMINOUS CEMENT, ITS PREPARATION, PROPERTIES, AND EMPLOYMENT IN BUILDING

Reported by DR. K. BIEHL

As soon as a cement of great strength was reported on the market in other countries, the German manufacturers undertook to produce a similar product. The new kinds of cement are the so-called "High Quality" portland cement and the fused aluminous cement. Germany has manufactured High Quality portland cement since 1920 and aluminous cement since 1924. The fused aluminous cement is the latest development in the field of hydraulic cementitious materials. The corresponding French product is named *"ciment-fondu"* calling attention to the fact that it is fused rather than sintered. The English material is called "aluminous cement" emphasizing its composition but not its method of manufacture. In Germany the product is called *"Tonerdezement"* or *"Tonerdeschmelzement"* (aluminous cement or fused aluminous cement) emphasizing both factors. The Elektrozementgesellschaft prepares fused aluminous cement under the name of "Alka Cement."

The speaker gave a resume of the literature of the subject. In Germany, the manufacture of high alumina cement has not been of long standing because of the lack of essential raw material. In France the operation has been carried on for a considerable period on a large scale because the French have at their disposal rich bauxite beds. The German beds in Vogelsberg and Westerwald are not important and the bauxite exists in an impure state. At first the procedure used to make portland cement was applied to high alumina cement, but it has been demonstrated that only through complete fusion of the raw materials can the latter be satisfactorily produced. For the fusion the mixture is treated in a water-jacketed kiln, preferably rectangular to round. A second fusion method involves the use of an electric furnace, either open or closed, using mainly carbon electrodes. Fusion in an electric furnace does not require previous treatment to eliminate carbon dioxide as is the case with the other method. The large carbon electrodes are cooled by water which runs through annular steel rings. Underneath is a removable hearth in which the fused mass is collected. With both water-jacketed kiln and electric furnace, the charge is introduced from above. The kilns are lined with pressed carbon. The effect in both fusions is a reducing one, part of the iron oxide in the water-jacketed kiln is reduced to iron; in the electric furnace, a portion of the silica is reduced to silicon, and in this case a by-product of valuable ferro-silicon is obtained. Bauxite may be used in the electric kiln and the excess of silicic acid removed by reduction. The water-jacketed kiln treats 30 to 50 tons raw material per day, the electric furnace (or kiln) 10 to 15 tons.

Fuel and Current Consumption

The fuel consumption of the water-jacketed kiln amounts to 25 to 30% of the fused cement; in the electric kiln 1.5 k.w. for each kilogram of cement. The quality of the fused aluminous cement from the electric kiln should be better. Efforts to introduce the revolving kiln for the preparation of fused aluminous cement have been unsuccessful because of the lack of proper lining material. The latest proposal in this connection is to combine the revolving and electric kilns.

The fused material from the kilns is collected in an iron vessel and cooled by either air or water. The product cooled by machines exhibits different setting periods. The cooled product is then broken and ground in a combination mill. Addition of gypsum to aluminous cement is not necessary. The starting time of setting is determined by the method of cooling used. Exact knowledge of the nature of fused cement is still lacking. Aluminous cement is a hydraulic cement manufactured from raw materials containing alumina and lime whereby a saturation of the acidic and basic constituents is accomplished. Aluminous cement contains a much higher alumina content than portland cement (35-55% as against 4-12% in portland), and a smaller quantity of lime and silicic acid. The iron oxide content is greater in aluminous cement. It also contains titanic acid.

Characteristics of Aluminous Cements

The hydrauliq modulus of high aluminous earth cement is 0.5 to 1.0 against 1.7 to 2.2 found in the best portland cement. The silicate modulus 0.1 to 0.3 against 1.2 to 4 of portland cement. A thin section of the aluminous cement shows large crystals. These are penta calcium aluminate and tricalcium aluminate. The latter is the chief constituent of aluminous cement according to the work of Dyckerhoff. The commonly accepted properties of the aluminous cement correspond to those of portland cement. The hardening is followed by a greater liberation of heat. With water, portland cement shows the change after 10 days that aluminous cement shows after two hours. It seems that three hours after the formation of the calcium-hydro aluminate there appears tricalcium aluminate plus water. After three hours a turbidity appears which perhaps is due to the colloidal aluminum hydroxide. After three to four weeks these gelatinous drops form crystals. A standard measured test of the "Alka" cement of a mixture of 1 to 3 with standard sand shows that five hours after the preparation the compression strength is 259 kg./cm.^{2}; the tensile strength 21 kg./cm.^{2}; after 10 hours the compression strength 474 kg./cm.^{2}; the tensile strength 23.3 kg./cm.^{2}. After 15 hours the compression strength 510 kg./cm.^{2}; the tensile strength 293 kg./cm.^{2} After 24 hours the compression strength 573 kg./cm.^{2}; the tensile strength 24.5 kg./cm.^{2} (Note: To change the above figures into pounds per square inch multiply by 14.2—Editors.) The cause of the hardening is perhaps to be found in the formation of the colloid. The above figures show how quickly the initial hardening proceeds. A comparison of the compression strength of the German with the French fused cement shows that in the beginning the French fused cement has a greater strength, but after 28 days, the German fused cement far surpasses it. A decrease in strength is not found in the German fused cement contrary to many assertions.

The srength of the German cement in sea water was examined. Since no free calcium hydroxide is liberated, no damage is done by sea water. Aluminous cement is not resistant to acid, but it withstands acids longer than other binding materials. Fused cement in a mixture of 1 to 3 was examined in various solutions as to its compression strength and it showed a tendency of increasing strength in water as well as in a 5% magnesium chloride, 5% magnesium sulphate and saturated calcium sulphate solution. Only sulphuric acid is injurious and in a 3% sulphuric acid solution aluminous cement loses its strength. A similar result is shown in the examinations made of test substances in proportion of 1 to 5. At any rate, it can now be said that the fused cement is distinguished because of its high

initial strength and because of its resistance to chemical action. Another important advantage of the aluminous cement is the ease with which it can be worked in low temperatures. This is important in building.

For the working of the fused cement the same principles hold as in the other cements, but one must work carefully in order to obtain the best results. Clean sand and the proper amount of water must be taken, the outside covering must be mixed thoroughly and well wetted. Mixing the fused cement with cement containing lime should be avoided. The lecturer showed photographs of the uses of aluminous cement for various building purposes, as for example the successful use in the reconstruction of the gas works of Hanover.

Discussion of Fused Cements

Max Polysius remarked that for many years the Polysius factory has performed experiments in order to produce a good cheap fused cement. In the laboratory by means of the electric furnace a faultless fused cement can be obtained. In order to carry out these experiments on a large scale, they were performed in the factory at Tschornewitz. When this became known the director went to the mine of the Wolf Company's works in Calbe where a pit for refrigeration was to be built out of fused cement. As is known, portland cement never could be used for the installation of a pit at temperature below zero. For this use fused cement has proved itself satisfactory, so that in the future without a doubt, pits will not be built with tubing but with fused cement, which is of great importance to the German cement industry. In building pits with the use of fused cement, 120,000 marks were saved. Many regard the portland cement industry as an enemy and competitor. As Polysius emphasizes, this is not the case and one must rather regard fused cement as an additional and supplementary material with many possible uses.

COMPARISON OF THE GERMAN AND ENGLISH METHODS FOR THE TESTING OF PORTLAND CEMENT

Reported by DR. S. HAEGERMANN

The relationship that the established values obtained by German and English methods of testing bear to each other was investigated. A comparison of chemical composition is easily made by means of analysis. The fineness of grinding is determined in England by sieves having a mesh of 895 to 5200 per square centimeter, while the German sieves have meshes of 900 to 4900. The volume stability is carried out by the English by Le Chatelier's method while the German test is that devised by Koch, yet the specifications meet both Koch's and Le Chatelier's requirements. A comparison of the strength values cannot be exact because these quantities fluctuate in the same method and the difficulty is increased by the existence of obsolete tests, but an approximate comparison can be made. The molded test pieces are used in different forms in the German and English standard test.

The English test pieces have a greater cross sectional break. A statement as to the amount of water to be added is also missing from the English standard. The English standard sand is also different from the German, the German standard sand showing a uniform grain. The analysis of standard sands shows that the English and German sands are not very different except that the iron oxide content of the English sand is about twice as great as that of the German sand; the English sand, too, has a pale yellow color due to the presence of iron oxide. Great differences are shown in the sieve analysis. On the 120-mesh sieves the German sand shows a residue of 98.9, the English only 66.7. The German sand has 36%, the English only 34% voids; the English standard sand must therefore behave more advantageously than the German. If the German and English results on crushing and tensile strength are compared, which were obtained with 1 to 3 mixtures with respective standard sands, after three, seven and 28 days water curing and 28 days combination cure, the English sand behaves better. Twenty-two different kinds of cement were used for a comparison of the strength tests and were examined according to both methods. The test for purity in cement according to the German standard is set aside; that this is warranted, is demonstrated by the results of this research. Lower values are obtained by German than by English testing methods. The variations are not as great in pure cement as in a mixture of cement and mortar. These values fall within a limit of error of plus or minus 3 deg. The German method places more emphasis on the crushing strength, which method is lacking in the English standards. The determination of the tensile strength after a curing of 28 days according to the English standard is of little value.

Discussion of Comparative Tests

Professor Kuhl observed that the cement made of the richest mixture has the greatest strength. It is also known that coarsely-ground cement shows a high degree of purity and he would like to investigate the question whether or not the value of residue from the sieving has been determined.

Dr. Haegermann declared the report deals with the coarsely ground tests, and moreover that the samples contain poorly heated grains. It is suspected that the uncombined clay and sand was the cause of the strength of the pure cement being higher than that in the mixture.

Dr. Hecht knew that the English and German standard sieves do not agree, for the English sieves use finer wires. The mesh opening is greater in the English sieve than in the German, and an English cement which has gone through a mesh sieve of 4900 is accordingly coarser than a German cement. Differences in the values received depend not only upon the different sands used and upon the different tests made, but also upon the different forms of the testing pieces. The values which we received from the English and German tests are not further comparable.

Dr. Strebel points out, that the difference in sizes of mesh of the sieve is correct, and he invites tests to be carried through on the differences of the fineness of both standard sieves. The standard German portland cement fulfills all other English requirements, except that of the sieve residue.

THE EFFECT OF HIGH TEMPERATURES ON HARDENED CEMENT, AGGREGATES AND CONCRETE

Presented by DR. KURT ENDELL

The effect of high temperatures upon concrete is of great technical importance because of the use of cement for structures where it is exposed to excessive heat, such as in chimneys, waste heat utilization apparatus, etc. Observations of damage by fire demonstrate the heat resisting qualities of cement. The low heat conductivity of concrete is responsible for the slight penetration. Frequently, observations made on small pieces are not paralleled in practice. The lecturer further investigated the problem of the effect of high temperatures on cement, aggregates and concrete and was concerned particularly with the decrease of mechanical strength after heating for short or long intervals up to 1000 deg. The question at which temperature water is evolved had not previously been considered. Besides, although the behavior of the aggregates at high temperatures has frequently been observed, many doubtful points exist. It was determined that the crushing strength of the binding material decreases with heat, that quartz and quartzose aggregate warp, that basalt and burned brick serve better for resistance to high temperatures and that the elimination of water from hard cement requires time.

The behavior of hardened cement was first determined by subjecting cubes having an edge 100 m.m. long to the standard tests. The tests were made on four different cements and covered two to three months. The manner in which water is eliminated is important so far as the influence of heat upon the deterioration of its mechanical qualities. The dependence of the loss on heating upon temperature and time was further investigated and the loss on heating on air and water cured cement was determined by heating for an hour at 100, 200, 300, 500, 700 and 1000 deg. and also by heating for five hours at 100 and 500 deg. The water is given up very slowly; after an hour the cement still retains 3-5% water, and after five hours the same loss is still observed. There is, apparently, a definite loss on heating for each temperature. This phenomenon is characteristic for gele or zeolite. The

effects of heating demonstrate the existence of hydrates and the temperature at which the loss of water occurs should be determined.

Concrete Contains Lime Hydrate

Hardened cement was heated in a platinum crucible and the heating curves plotted for portland cement and calcium hydrate. At 100 deg. a large amount of heat absorption occurred, for at this point the loosely combined water goes off.

A second irregularity occurs in the curve at 530 deg., where further evolution of water occurs, and this temperature corresponds to the dissociation temperature of calcium hydrate. The investigation of the heating curve presents additional evidence that calcium hydrate exists as such in hardened cement, a fact made known by von Kayserman and Passow. The research demonstrates that three kinds of losses of water can be observed.

1. Loosely combined water is lost at 100 deg.
2. Water combined as calcium hydrate goes off at 530 deg.
3. Water containing compounds which can be dissociated only with difficulty give up their combined water slowly and only at 1000 deg.

The expansion of cement due to heat up to 800 deg. was also investigated and the relation between the hardness of cement and aggregates. The phenomena of the heat expansion above 100 deg. is very complicated. Stiger's heat expansion apparatus was used. The difficulty arises from the fact that contraction also occurs concurrently and partially compensates for the heat expansion. Up to 200-300 deg. an expansion is observed, beyond that a contraction, which is connected with the loss of water. Water-cured cement shows less contraction than air cured or cement cured by a combination of methods. The last shows first a slight expansion and then a contraction. All the cements still retained combined water after the experiments on the expansion due to heating.

Effect of Character of Aggregates

The aggregates were also examined such as quartz, granite, basalt and blast furnace slag. Quartz and granite expand up to 500 deg., and then undergo an alteration due to the change of alpha into beta quartz, which is accompanied by cracking of the material.

Basalt and blast furnace slag show a smaller expansion due to heat and one which proceeds uniformly. Quartz mixed with standard sand shows likewise the same alteration as unmixed quartz. A mixture of basalt and sand exhibits heat expansion which proceeds uniformly.

The results can be summarized as follows: Pure hardened portland cement contracts to a greater or less degree at temperatures over 200 deg., the contraction depending upon the evolution of the strongly combined water. The removal of the loosely combined water is more doubtful. Quartzose aggregate exhibits a large expansion and the effect of the change in quartz from the alpha to the beta forms at 530 deg. Basalt and blast furnace slag exhibit a smaller expansion. Mixtures of quartz and sand in the proportion of 1:3 and quartz-concrete exhibit the same behavior as the pure aggregate.

The practical results of this investigation show that for heat resisting structures such as smoke-stacks, waste heat apparatus, coke quenching towers, etc., quartz-containing mixtures should not be used, but aggregates composed of basalt, blast furnace slag and limestone should be employed because of their slow and uniform expansion.

THE LABORATORY TESTING OF CEMENT AND ITS APPLICATION TO THE INVESTIGATION OF SINTERING PROCEDURE

Read by DR. KUHL

Research on cements is often made upon very small amounts of substance and the limitations of the scientific investigation is greater, the smaller the amount of material worked with. Many of the great attainments in the investigation of the cement problem have been achieved by the work on very small portions of material; for example, the pioneer work on calcium silicate and calcium aluminate by Otto Schott, the numerous researches on fusions by the Carnegie Institute in America, Jaennecke's work upon the existence of the now so-called Jaennecke's compound and the work of Nackin and Dyckerhoff upon the dissimilar densities in ternary systems.

A method of testing strength has been developed for working with small quantities which depends upon breaking the molded test piece rather than crushing or tearing it apart. The apparatus used was a tensile strength machine built according to Fruhling-Michaelis' directions. Molded slabs in the shape of small prisms, 3 cm. long and 1 sq. cm. cross section were used. The ends of these small slabs were firmly held by two clamps and broken by the application of a load. When the test piece is molded without pressure considerable fluctuation in results are obtained. They were formed therefore under pressure. The prisms were set on a base held rigidly on a stand, and a device which holds the clutch which breaks the test piece is operated by a side lever upon which force is applied.

The method serves to test any mortar-mixture, from pure cement to the leanest mixture. Standard sand could not be used because of the large grain and this was ground in a ball mill to 225-900 mesh before use. The grain of the sand used was between 0.22 and 0.44 mm. in size. The water added for the sand tests was 11%; for the tests on pure cement, 18%. The pressure used in forming the prisms in both cases was 400 kg./cm.^{2} As the duration of the pressure also has an influence, the latter was applied very gradually until the above mentioned figure was reached and kept there a few minutes and then the pressure gradually released. An idea of the efficiency of the method of testing can be obtained by a comparison of the figures for the breaking strength with the familiar values obtained by the usual tensile and crushing strength tests. The values for the breaking strength are small, due to the use of proportionately finer sand and because of the method of preparing the test pieces. It is interesting to note that the ratio of the smallest value to the largest by all three strength tests—breaking, tensile and compression—is 1:3. Accordingly, by the three methods of testing the difference between good and bad cement is about the same; in other words, each of the three methods can be used to form an opinion of the value of cement. The three methods of testing do not, however, run parallel. The values for the tensile and crushing strengths can be approximated from the breaking strength by multiplying, for the former by 2 and the latter by 30.

Results with New Method of Testing Cement

The speaker then described the work done by Ullrich in his laboratory, who used for the first time the new method of testing. In this work the influence of sintering temperature, duration of sintering and rapidity of cooling upon the properties of cement were investigated. The research on sintering was carried out with small quantities in an electrically heated furnace. In order to avoid contamination and possible chemical reaction, the raw mixture was shaped in the form of a lead pencil, wrapped in platinum foil and introduced into the furnace. The slab of clinker when finished burning was broken with a hammer and ground to the size of grains of standard sand (ground in a porcelain ball mill with a fixed grade of fines) and finally tested for breaking strength as described above.

One new result was obtained: If the clinker, after chilling, still has a temperature over 1275 deg., it has a reddish brown appearance; if it is first cooled below 1275 deg. and then suddenly quenched, the normal greenish-black appearance of portland cement clinker is obtained. This observation is in accord with Kuhl's conclusion that the existence of red and brown colored clinker has no relation to the oxidation or reducing flame, as heretofore assumed, but is a function of the temperature and the rapidity of cooling.

The speaker also described a method of testing small quantities of cement for its size of grain by sedimentation. A tube 120 cm. long fitted with side outlets was used. This is filled with alcohol. The cement to be tested is suspended in a thin paste in alcohol, introduced into the upper end and allowed to settle. The cement stratifies according to the size of its grain. The side

outlets are opened in quick succession, the alcohol filtered from the 10 fractions, and the cement in each case weighed.

Dr. Schott in the discussion that followed expressed the belief that smaller test pieces may be used instead of those three cm. long.

REPORT OF THE KILN COMMISSION

Presented by DR. SCHOTT

The use of a Stehmann cooler in kilns for wet process operation results in a saving of 4.18% of coal. On the other hand the cooler reduces the capacity of the kiln. It operates with a very slight excess of air, only 1.9 times the theory. The object of the cooler is to strongly preheat the air, the waste gases leaving the kiln at a temperature of 381.5 deg. when the cooler is used and at 503 deg. when it is not. The temperature of the air just previous to combustion is 643 deg. when a cooler is used, and only 104 deg. without one. The high cost of the apparatus is an objection.

The new procedure developed by Marguierre has much reduced the cost of investment. The method involves the use of water, which has been heated to its saturation temperature in a boiler, and then brought to a high pressure, by means of a pump, and brought again to the starting point by means of a throttling device. Following the rise in pressure caused by the pump, the water can be raised to a higher temperature without causing the formation of steam. The pressure of the corresponding saturation temperature is not quite reached. The mass of water is regulated by the operator so that its temperature remains constant. Three per cent of the water vaporizes at the release of pressure. It is separated and heated in a super-heater. A corresponding amount of water is added to the cycle, first preheated and then fed to the vaporizer. This procedure for the utilization of waste heat can be employed by the use of parts already at hand. Instead of the waste heat boiler, one may use the less expensive economizer, instead of the steam boiler and economizer, one may use only the economizer and pumps, as follows: In the economizer the water is raised to a high pressure by the pump, if the pressure is now lowered by release, vaporization takes place. Results show that this procedure is just as successful as the other. Good results are obtained by the use of a small excess of air. This can be demonstrated by the carbonic acid content of the waste gases, for the determination of which the Orsat apparatus is very valuable.

More Heat Recoverable from Hot Clinker

The research also showed that the heat which is recoverable from the hot clinker is greater than has heretofore been thought. Fourteen per cent of the total heat of the clinker can be recovered.

Summary of the results obtained with the previously examined kilns, Polysius' "Solo" kiln, calcining kilns, also wet operation with and without the Stehmann cooler and in addition with utilization of waste heat follow:

The loss of time involved in a rotation of the Solo kilns, 50 sec.; calcining kilns, 60 sec.; kilns with the Stehmann cooler, 132.5 sec., and kilns without the cooler, 137.5 sec., and with the use of waste heat boilers, 225 sec.

The author believes that the kilns must be allowed to move rapidly, but that the slope has heretofore always been made too great.

The heat absorption for 1000 kg. of clinker was greatest for the wet kilns without the Stehmann cooler, the heat requirement for 100 kg. clinker in heat units for the Solo kiln 197,125, for the calcining kiln 181,800 for the wet kilns with Stehmann cooler, 190,705 for the latter without the cooler 226,234 and by employment of waste heat 103,052.

TEMPERATURE OF FLUE GASES

Solo kilns	409 deg.
Calcining kiln	946 "
Kilns with Stehmann cooler	381 "
Kilns without Stehmann cooler	503 "
With waste heat utilization	746 "

THE MIXING OF CEMENT

By RUDOLF GRIMM

As yet no entirely unobjectionable explanation of the phenomena of cement mixing has been found. The author has made progress in this problem, working with Dr. Schlobach. The original work of these investigators upon various cements indicates that the gypsum content is frequently a decisive factor in the cement mixes, and commercial mixes were made in which gypsum was added to the finely ground cement.

It was pointed out that the carbonic acid absorbed from the air has an effect. It may readily be assumed that rapid setting is attributable to the formation of potassium carbonate from the potash of the cement. It was determined that gypsum-containing cements can be made to set more rapidly by the addition of potassium carbonate or more slowly by addition of gypsum. The speaker concludes that the cause of the rapid setting is to be found in the action of the potash, and that potassium aluminate is probably the activating substance.

In the discussion, Prof. Kuhl considered it probable that potassium aluminates are the cause of rapid setting but did not believe that cement contains these substances in the free state, but rather dissolved in Alite, Belite, etc. The carbon dioxide of the air affects cement only in the presence of water.

Fluorspar and Cryolite in 1925

NOTWITHSTANDING the record production of steel in 1925, the shipments of fluorspar to steel plants were 12% less than in 1924. There was also a decrease of 12% in shipments to foundries. Of the higher grades of fluorspar, the shipments to manufacturers of glass and hydrofluoric acid were, respectively, 11 to 41% more than in 1924, but shipments for use in enamel and sanitary ware were 7% smaller.

Total shipments of fluorspar from domestic mines in 1925 amounted to 113,669 short tons valued at $2,052,342, a decrease of 9% in quantity and 16% in total value as compared with 1924. General average value per ton f.o.b. mines or shipping point for all grades was $18.06, a decrease of $1.55 from the 1924 average. New Mexico was the only state to show increased shipments in 1925.

According to reports from producers, the total quantity of fluorspar in stock at mines or shipping points at the end of 1925 amounted to 66,886 tons, a decrease of 4% from 1924. These stocks consisted of 22,551 tons of ready-to-ship material and 44,335 tons of crude, which must be milled, calculated to be equivalent to about 26,000 tons of ready-to-ship fluorspar.

Total imports of fluorspar in 1925 were 48,700 short tons, the second largest ever recorded. This is equal to 43% of the domestic shipments. The imports show a decrease of 5% in quantity and 16% in total value over the record year of 1924. The value assigned to foreign fluorspar averaged $9.63 per ton. Exports in 1925 were 1055 short tons valued at $17,574 or $16.66 per ton compared with 617 tons valued at $14,489 or $23.48 per ton in 1924. With the exception of 30 tons to Mexico, all the exported went to Canada.

Governors Invited to Good Roads Show

MORE than 70 active and former governors will be asked to participate in a Governor's Day program to be held in Chicago on Tuesday, January 11, in connection with the twenty-fourth annual convention and road show of the American Road Builders' Association.

H. G. Shirley, president of the American Road Builders' Association and chairman of the Virginia State Highway Commission, who is completing arrangements for the big highway meeting scheduled for Good Roads Week, January 10 to 15, has announced that all former governors will be invited to attend the meeting in addition to those now in office.

President Shirley announced the appointment of H. K. Bishop, chief of the division of construction of the United States Bureau of Public Roads and a member of the association's board of directors as general chairman of the program committee. Paul M. Tebbs, of the Pennsylvania Department of Highways and S. M. Williams, Chicago, a member of the board of directors, were appointed sub-chairmen.

Slate mills at a typical Pennsylvania slate quarry

Yard filled with roofing slate—splitting shanties show in rear

Recent Progress in Slate Technology

Reports of Investigations Carried on by the Bureau of Mines, Department of Commerce

By Oliver Bowles

Superintendent, Nonmetallic Minerals Experiment Station, Bureau of Mines, New Brunswick, N. J. (In cooperation with Rutgers University)

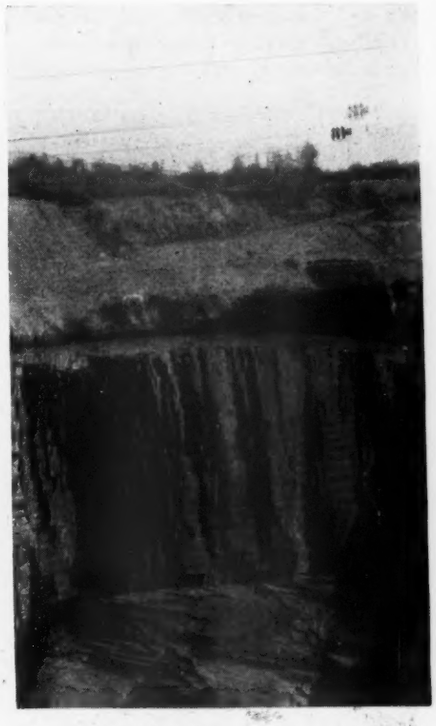
SINCE 1922 when the Bureau of Mines issued a report* covering the slate industry in detail, changes in technology have taken place which have an important bearing on the industry. The present paper comprises a record of these changes.

Though the value of slate for roofing, structural, blackboard, sanitary, and electrical uses is generally recognized, it has many competitors. To meet this constantly increasing competition producers are promoting economies in manufacture and improving processes, thereby lessening costs of production, and are placing on the market products of the highest possible quality, thus creating satisfaction and confidence on the part of the user. This endeavor to place the industry on a better basis, both as regards processes and products, is shown in the recent developments in technology which are presented herein.

Valuable assistance in obtaining data for this paper was given by W. S. Hays, secretary of the National Slate Association, N. M. Male, president of the National Slate Association, and Robert Notvest, consulting engineer, Cleveland, O.

Mills for the Manufacture of Roofing Slate

From the beginning of the industry one standard method of making roofing slate has been generally followed. The rough blocks from the quarry are sent to the splitting shanty where they are first reduced in size, usually by plug and feather in drill holes; masses are easily split in the cleavage direction by driving wedges. The blocks are "sculped" (broken in the direction of the grain) usually by notching with a chisel and then striking sharp blows with a wooden mallet. Separation across the grain may be made by sawing or by notching and breaking with a mallet. Masses thus broken into suitable lengths are separated by hammer and chisel into thicknesses sufficient for eight slates each. The blocks are then ready for the splitter who subdivides them with a wide flexible chisel and a wooden mallet into roofing slates which are usually about three-sixteenths of an inch thick. The slab is always split in the center until the desired size is obtained. The slates are then taken from the splitter and trimmed to a rectangular shape. The most common equipment used in Pennsylvania is a straight blade operated by a foot treadle. In Vermont rotary trimming blades are in common use, most of them being operated by foot power, though at some plants they are belt-driven from a countershaft. A steel gage bar on which the slates rest is provided with a series of notches which serve as a guide in trimming the slates to any standard size. The finished slates are then piled in racks. The above method involves much tiresome work in handling the heavy blocks, in operating the foot treadle, in carrying out and piling the finished slates, and in disposing of the waste.



Section of a properly worked slate quarry

In the recently published bulletin of the Bureau of Mines a description is given of an efficiently planned mill in the New York-Vermont slate district designed entirely for the manufacture of roofing slates. Pennsylvania operators have realized the need of similar labor-saving equipment, and within the past year several new roofing slate mills have been erected in the Pen Argyl district. The mills are provided with overhead traveling cranes or derrick hoists to handle the heavy blocks. Many of the blocks are cut with circular saws. By using saws the objectionable "ribbons" or "hard ends" may be cut off, and thus many blocks may be

*"The Technology of Slate," by Oliver Bowles, Bureau of Mines Bulletin 218.

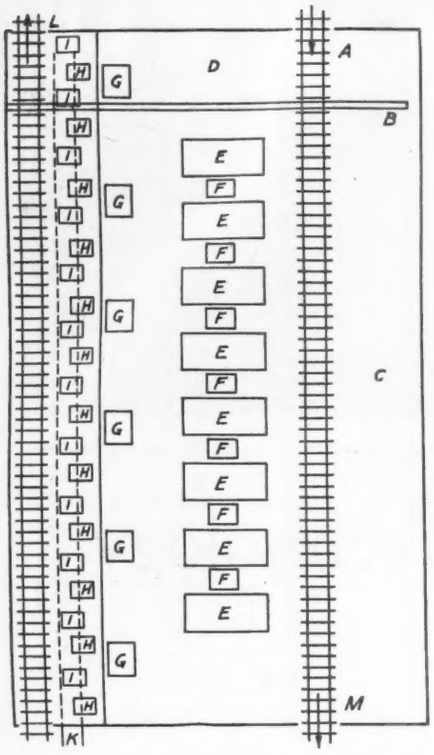


Fig. 1. Plan of Jackson-Bayor Slate Co. roofing slate mill. Key to diagram —A, Track for slate blocks; B, Overhead traveling crane; C, Block storage; D, Extra rainy day storage; E, Saw beds; F, Box for waste; G, Position of blockmakers; H, Position of splitters; I, Position of trimmers; K, Belt conveyor for waste; L, Track for portable slate racks; M, Track for waste

used which by the old method would be thrown away. The saw cut provides a smooth surface which makes splitting easier and it also tends to conserve slate for it is straight, while the breaking method often results in crooked and uneven fractures. In these mills one block-maker and helper can provide blocks for two splitters. By the old method the splitter spent part of his time making blocks, piling slates or shoveling rubbish. By the new method he splits practically all the time. All the trimming machines in the mills are power driven, thus the tiring operation of the foot treadle is avoided. Also the finished slates are piled in portable racks mounted on wheels. The filled racks are hauled to the storage yard by gasoline locomotive, horse or other means. Thus the arduous rehandling of slate is avoided. The waste from both trimmer and splitter falls down, slides into cars on depressed tracks, and thus are conveyed to the dump. The newest mill is provided with a 30-in. belt conveyor, 500 ft. long, for removal of waste. It travels through a tunnel beneath the floor on which the splitters and trimmers work. The ability of the slate makers to split and trim steadily without delay for removal of waste and finished slates is reflected in daily output. Where by the old method a splitter and trimmer would make seven or eight squares a day, by the new method they make 10 to 15, and have even attained a maximum of 20.

Figure 1 is a plan of a new mill just completed by the Jackson-Bangor Slate Co. at Pen Argyl. All the saw beds are provided with direct unit motor drive. Figure 2 is a plan of Parsons Bros. Slate Co. mill at Pen Argyl. Blocks in this mill are handled by two derrick cranes supplemented by a light overhead electric crane. Seven mills, all of this same general type, have been built in the Pen Argyl district.

New System Utilizes Slate to Greatest Advantage

One great advantage of the new system is the facility it affords for utilizing the slate to best advantage. By the old method many blocks unsuited in shape or quality for rapid conversion into roofing slates were thrown on the dump. By the new method objectional parts such as ribbons or hard ends may be cut off with the saws, the remainder being in good condition for splitting. Also blocks suitable for the more profitable blackboard manufacture are diverted to that use, and when they are sawn into blackboard stock the rejects may be used for roofing slate. It is estimated by one operator that through the practice of such economies one-quarter to one-third of the roofing slate now manufactured is obtained from blocks which by the old method would have been discarded as waste. Waste is one of the biggest and most complex problems now confronting the slate industry, therefore from this standpoint the new development is to be regarded as a step in the right direction.

However, certain disadvantages must also be given consideration. The erection of mills with saw beds, cranes and other mechanical equipment is costly and the maintenance expense is high as compared with

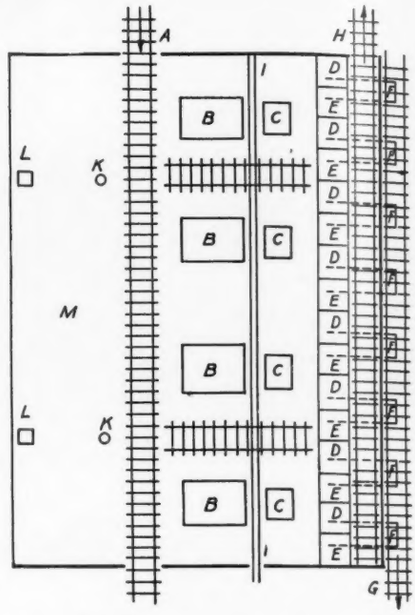


Fig. 2—Plan of Jackson Bros. Slate Co. roofing slate mill. Key to diagram —A, Track for slate blocks; B, Saw beds; C, Position of blockmakers; D, Position of splitters; E, Position of trimmers; F, Waste spouts beneath floor; G, Depressed track for waste; H, Track for portable slate racks; I, Overhead electric crane; K, Derrick cranes; L, Electric derrick hoists; M, Block storage

the extremely low investment and expense connected with the ordinary splitting shanty. Furthermore, sawing is in some cases less advantageous than sculping (a term applied to breaking in the direction of the grain and breaking across the grain). If a block breaks well it is cheaper to break than to saw. Also if the ribbon runs diagonal to the cleavage a block will not saw to advantage by the methods described above.

Looking down into a well operated slate quarry

Briefly, the advantages of the new system are:

(1) Improvement in labor conditions through mechanical handling of blocks, finished slate and waste. (2) Increased output per man through systematic and orderly succession of processes and through mechanical devices for handling materials. (3) The saving of a considerable percentage of rock that was wasted under the old system. (4) Easy diversion of the various grades and qualities of slate to uses for which they are best suited. (5) Favorable conditions for training new men in the art of splitting and trimming.

The chief disadvantages are:

(1) Heavy investment and high maintenance expenses and (2) high cost of sawing, and less advantageous results in some instances.

Use of the Gang Saw

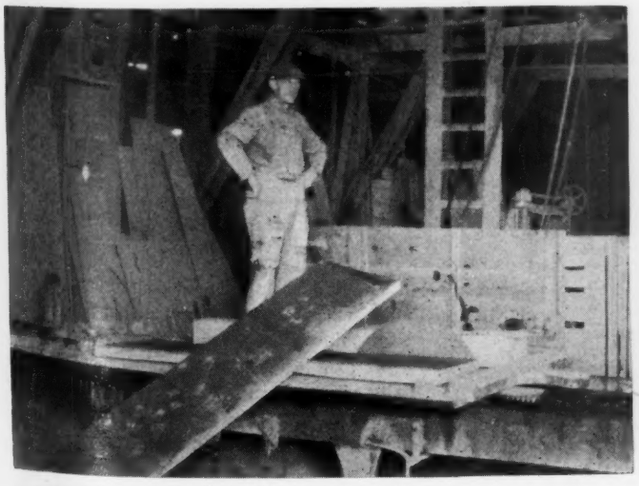
Gang saws consisting of a series of straight steel blades fed with sand or other abrasive with water, and having a forward and backward stroke, are in common use in stone mills, particularly for sawing marble and sandstone. Until recently they have not been used on slate, but within the past few months a modified type has been developed, and is in successful operation in several slate mills in the Vermont-New York district. The blades, consisting of hardened steel, are 4 to 6 ft. long, about ¼-in. thick, and have a series of five or six notches in the cutting edge. Four to 10 blades may be used in a single gang frame. The stroke is about 15 in. Steel shot is used as abrasive. Water is supplied automatically from overhead piping, but the abrasive is shoveled on by hand. The blades descend by automatic gear feed. The rate of sawing varies somewhat according to the hardness of the slate. One gang observed consisted of seven blades cutting an average width of 2 ft. Its rate of sawing was 6 in. in 16 minutes. To reduce loss of time between cuts the blocks are mounted on cars. When a cut is completed the car is shifted, and a car with a new block already loaded is run beneath the blades. The abrasive is collected on a concrete floor and is used repeatedly, though new abrasive is frequently added. The water may be drained to a settling tank from which even the finest abrasive may be recovered for further use.

Hand operated trimming machine for slate from 1 to 2 in. thick. This has been replaced in many plants by machines using electric power

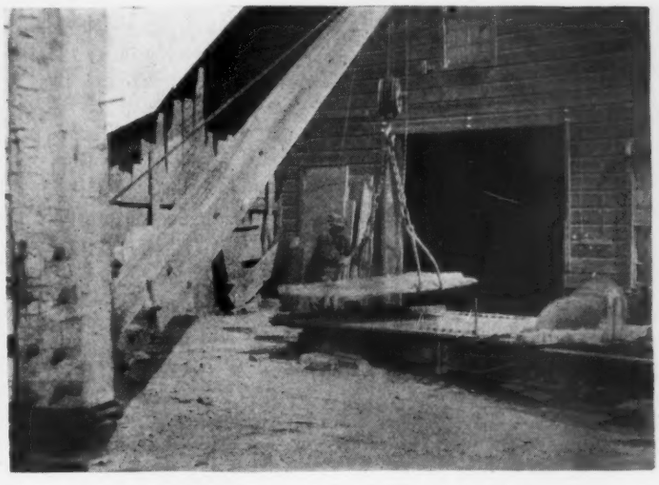
The gang saw is new in the industry, and undoubtedly refinements will be developed increasing its efficiency. A mechanical means of returning the abrasive to the blades would be advantageous. Both centrifugal pumps and air lifts are successfully used for the elevation of crushed steel and water at sandstone sawing mills. A centrifugal pump installed with the first machine tried on slate was found to be impracticable, as a man could feed shot to the saws with less waste of abrasive, less wear on the machine and at a faster rate of sawing. Where several machines could be fed by one pump the pump feed would probably be best.

It might be of advantage also to use a harder steel on the cutting edge of the blades. It was observed that blades in use for some time were worn down at least 1/32 in. from the original thickness. A tapering blade tends to bind as it descends, increases the power consumption through excessive friction, and it also grinds up the abrasive unnecessarily. This difficulty might be overcome by using manganese steel blades. Tests have been made in welding stellite to the edges of the soft steel saws, but it was found that chilled steel shot abrasive did not cling to the hard steel as well as to the soft steel, and no advantage was apparent. Other types of hard steel may be tried.

The usual method of sawing slate is by means of toothed circular saws which are satisfactory in soft slates fairly free from flint and pyrites. The gang saw is used chiefly in slate too hard for cutting with the circular saw. Such slates have always been sculped on the grain and broken across by sledging. It is claimed that by use of the gang saw the waste is reduced as much as



Interior of a slate plant showing circular saw cutting a slate slab



Heavy slate slabs carried to sawing machine by a derrick hoist

30%; also the sawn blocks have smooth ends which are advantageous for splitting.

Air-Driven Slate Splitter

A splitter has been developed by Hugh G. Williams in the Vermont district embodying the principle of the compressed air hammer drill. A thin flexible blade is attached to the air operated mechanism, and by pressing a small lever or thumb-latch rapid vibrations are propagated. When the blade is pressed against a slate slab the rapid impact splits it readily. The most marked advantage is in splitting tough slate, where by the hand-splitting method the split may require starting on the sides as well as on the end of the block, in order to carry it through without breakage. When the air driven tool is used the long flexible blade passes right down the center of the block and splits it cleanly with no assistance from the sides. It is claimed that an operator, even with little experience, can split much more rapidly with the new type of splitter than with the ordinary chisel and mallet; also there is much less waste through breakage.

Struco, a New Slate Product

The Structural Slate Co. of Pen Argyl, Penn., has placed on the market a new slate product with the trade name "struco." It consists of slate slabs with lacquer finish in various colors and patterns. The standard colors are white, gray and green, but others may be easily prepared. The base is of nitro-cellulose origin, and the vehicle or solvent is a volatile hydrocarbon. Unlike a paint, the drying and hardening is brought about by evaporation rather than by oxidation. The slate slab is first polished with a belt sander or buffer. The lacquer is then applied to the surface with a spray nozzle operated with compressed air. The highly volatile solvent evaporates in 15 or 20 minutes, leaving a firm, hard surface. A transparent base coat is put on first, after which two or three applications of the desired color are made by successive sprayings. A final coat of colorless lacquer may be added, after which the surface may be polished. Very attractive designs are made by adding a spatter coat, such as white over gray green. The spray nozzle is adjusted to throw large or small drops as desired, and when evenly sprayed a blotched or speckled surface is obtained. The spots are not really superimposed on the base, for the solvent present in the drops eats into the base coats and thus establishes the spots as parts of the lacquer layer, reaching right through to the slate backing. "Crackled" or "crazed" effects resembling crocodile skin are also obtainable.

The surface is unaffected by sudden changes of temperature, by hot water, acids, alkalies or any other ordinary agents of disintegration. The natural slate backing is subject to very slight contraction or expansion, will not rust and, being chemically inert, has no tendency to cause cracking or peeling to make a poor appearance.

Slate used as a building stone gives pleasing architectural effects

An objection to structural slate in some locations is its dark and somber color. Struco is designed to overcome this objection by furnishing a structural slate in any desired color. A white, porcelain-like finish can be provided for shower stalls and other sanitary uses. The new product is in demand for wainscoting in schools, club houses, halls and in pantries, kitchens and bathrooms in hotels or private homes. The smooth, polished surface is permanent, sanitary and is easily kept clean. Struco is not designed to replace slate in its legitimate field, but rather to find use in places where colors other than natural slate are desired.

One large mill is now in operation at Pen Argyl, Penn., for the manufacture of the new product, and the facilities will be enlarged as the demand increases.

Architectural Slate

In past years the main demand has been for smooth slates of uniform size and color. Recently, however, there has been an insistent demand by architects for rough and irregular slates of variable size and varying greatly in color. Such "architectural grades" are produced mainly in the Vermont-New York district, where variegated and mottled colors are abundant. The variations in sizes, colors and surface configuration produce rustic effects that are very attractive, particularly in large structures. The demand for this type of slate has been advantageous to producers. No substitute materials have been found that provide the rustic effects of the natural slates, and therefore this branch of the industry has grown rapidly. Furthermore, these large and heavy slates, some of them attaining a thickness of 1 to 2 in., may be manufactured from beds having too poor a cleavage for manufacture into the standard grades of roofing slate. Thus a more complete utilization of the quarry rock is possible than otherwise.

Many of the attractively colored slates are obtained in the upper parts of the deposits in or near the zone of surface weathering. On this account it is imperative that a very definite warning be issued against the danger of sacrificing permanence for color effects. Recently the writer observed in the Granville, N. Y., district numerous small quarry openings from which slates are taken out at points not more than 3 or 4 ft. below the surface. The reddish, yellowish or variegated colors are due in part at least to surface leaching of iron from the overlying soil, or to disintegration of the slate itself. While the architect's demands for "golden pheasant" and other striking colors are fully met, slates taken so near the surface are partly altered by weathering, and therefore their enduring quality is impaired. Every slate producer should jealously guard the reputation of his product. He should recognize that permanence and stability are the outstanding qualities upon which that reputation has been built, and he should persistently refuse to market inferior slates. As very attractive color effects are obtainable in sound slate, there is no need of resorting to unsound material. Wide sales of partly disintegrated slates are bound to cast discredit on the industry before many years have passed.

The Use of Power-Driven Punching Machines

The nail holes in roofing slates are usually made with foot-operated punching machines. With the recent increased production of thick and heavy slates electrically operated drills have been used. As drilling is a comparatively slow process, motor-driven punches have recently been introduced. Some of them will punch slates up to ⅜ in. thick, while others of heavier type will punch up to ¾ in. or even 1 in. in thickness. It is

claimed that the percentage of breakage is very small and that punching is much more rapid than drilling.

Trimming Machines for Heavy Slates

Electrically driven machines are now in use for trimming heavy architectural grade slates. Imperfect parts are removed and the slates cut to the desired size and shape by means of powerful blades which will cut slates 1 to 2 in. thick. Some machines are adapted for cutting wavy or irregular edges to emphasize the rustic effect.

Utilization of Irregular Fragments

Irregular pieces of slate of a class usually discarded are finding increasing use for slate floors, walks and rustic pavements. Fragments of random sizes and shapes are also employed in making a rough cleft masonry wainscoting that is attracting considerable attention. A wider use of slate in this field is forecast when its architectural possibilities are more generally recognized.

Floor Tile and Sawn Shingles

Floor tile are made in many slate mills. The usual method is to saw and split the blocks and to grind them smooth and true on a rubbing bed using sand as an abrasive. A mill is now in operation at Granville for the cutting of tile with a carborundum machine. It is a multiple wheel machine making a maximum of 10 cuts simultaneously. The bed on which the slate rests may be rotated 90 deg. so that when the cuts are made in one direction the cross cuts may be made with very little delay and without disturbing the slabs. The carborundum machine combines speed with accuracy and leaves smooth surfaces requiring no further treatment. The tile are cut so true that when placed together the joint is an almost imperceptible hair line. Sawn shingles are also manufactured on the carborumdum machine. An advantage claimed for such shingles is a solid edge which is not shattered in any way therefore the water absorption is comparatively low.

Slate Veneered Shingles

In the bureau's report on slate reference was made to the proposed manufacture of roofing shingles consisting of a composition backing surfaced with a slab of slate ⅛ in. thick. Many difficulties were encountered by a large company at Bound Brook, N. J., both in sawing and splitting the slate selected for this purpose and the work was discontinued. Recently the Slate Products Co. of Granville, N. Y., has undertaken the task of perfecting the process and manufacturing the shingles. A modified Lake slate-splitting machine is used to split the slabs. The composition backing is 18 in. long, but the veneer covers only 8 in. of it. The shingles may be laid in the same way as wooden shingles. They are much lighter in weight than slates, and may be nailed without previous punching.

Studies in Physical and Chemical Properties of Slate

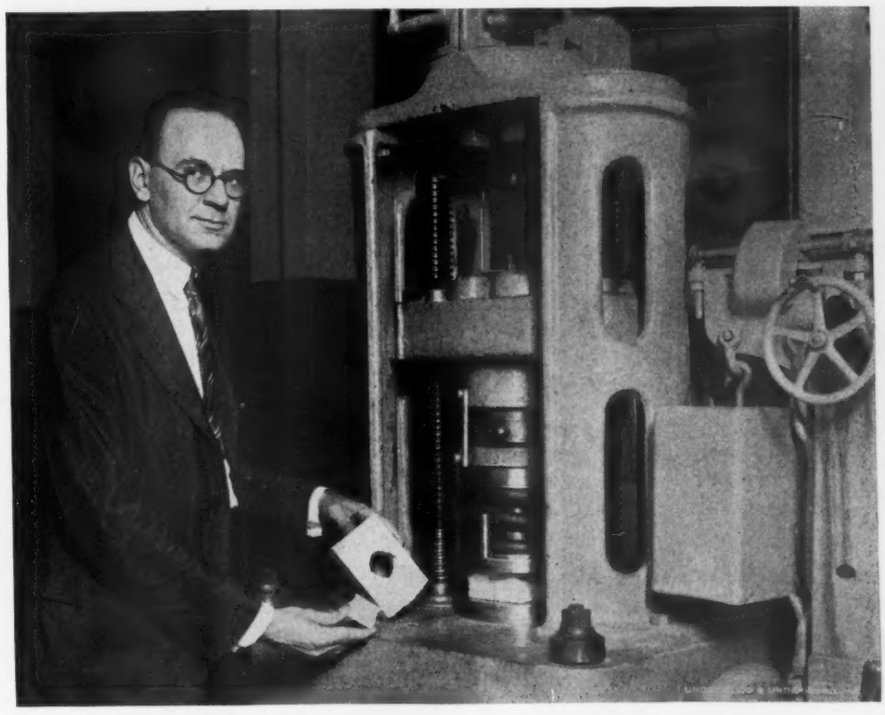
Slate is a natural rock, and, unlike a synthetic product, its properties are inherent and practically unchangeable. However, slates from different localities, and even from different parts of the same deposit, vary greatly in physical character and in chemical composition. By diversion of each type to the uses for which it is best adapted, more serviceable and dependable products are supplied than where little attention is given to adaptability. There is a growing tendency among slate producers to gain a better knowledge of the fundamental properties of their raw materials and to utilize this knowledge in the selection of material best suited for its intended use. It has been learned, for example, that calcium carbonate is injurious in slate exposed in any way to sulphuric acid, because the hydrated calicum sulphate, gypsum, is formed, and its formation is accompanied by great expansion which disintegrates the slate. Fortunately most of the commercial slates in the United States are low in calcium carbonate, but it has been demonstrated that slates with any appreciable percentages should not be used where acid exposure is probable. It has also been found that slates vary greatly in transverse strength. Naturally the stronger slates should be used for stair treads, sills, caps and other applications where a load must be carried. Physical, chemical and microscopic studies are conducted mainly at the Bureau of Standards, Washington, D. C., and by Robert Notvest in a private laboratory in Cleveland, Ohio. In the latter laboratory methods and apparatus have been developed for testing strength, hardness, abrasion and ohmic resistance.

Work of the National Slate Association

The National Slate Association was organized in 1922 to promote the general interests of the commodity, to extend the markets through advertising, to obtain more favorable freight rates, to encourage research and to establish better methods of operation and utilization. A noteworthy accomplishment of the association is the publication of two bulletins, "Standard specifications for floors, walks and terraces" and "Slate roofs." The latter is an illustrated text book covering all details of construction and materials. Another accomplishment was the organization of Committee D-16 of the American Society for Testing Materials. Its purpose is to accumulate all necessary fundamental data as a basis for the establishment of slate standards. A tentative standard definition of slate has been formuluted, and progress has been made with standard testing methods. The association has also promoted valuable co-operative research with government bureaus and other agencies.

Device for Shearing Stone

ONE of the latest developments of the U. S. Bureau of Standards is a new shearing tool for stone which has been developed by H. H. Dutton of the bureau. Through the use of this machine it is claimed that the perforation of stone will be greatly facilitated. The accompanying picture shows the inventor and the machine, which is capable of exerting a total load of 40,000 lb. Greater simplicity and ease of operation over shearing tools now in operation are some of the important features.



New machine devised for shearing stone. H. H. Dutton, the inventor, demonstrating its operation

The Design of Stone Crushing Plants

Part VI.—Medium-Sized Plant with Gyratory Type as Primary Crusher

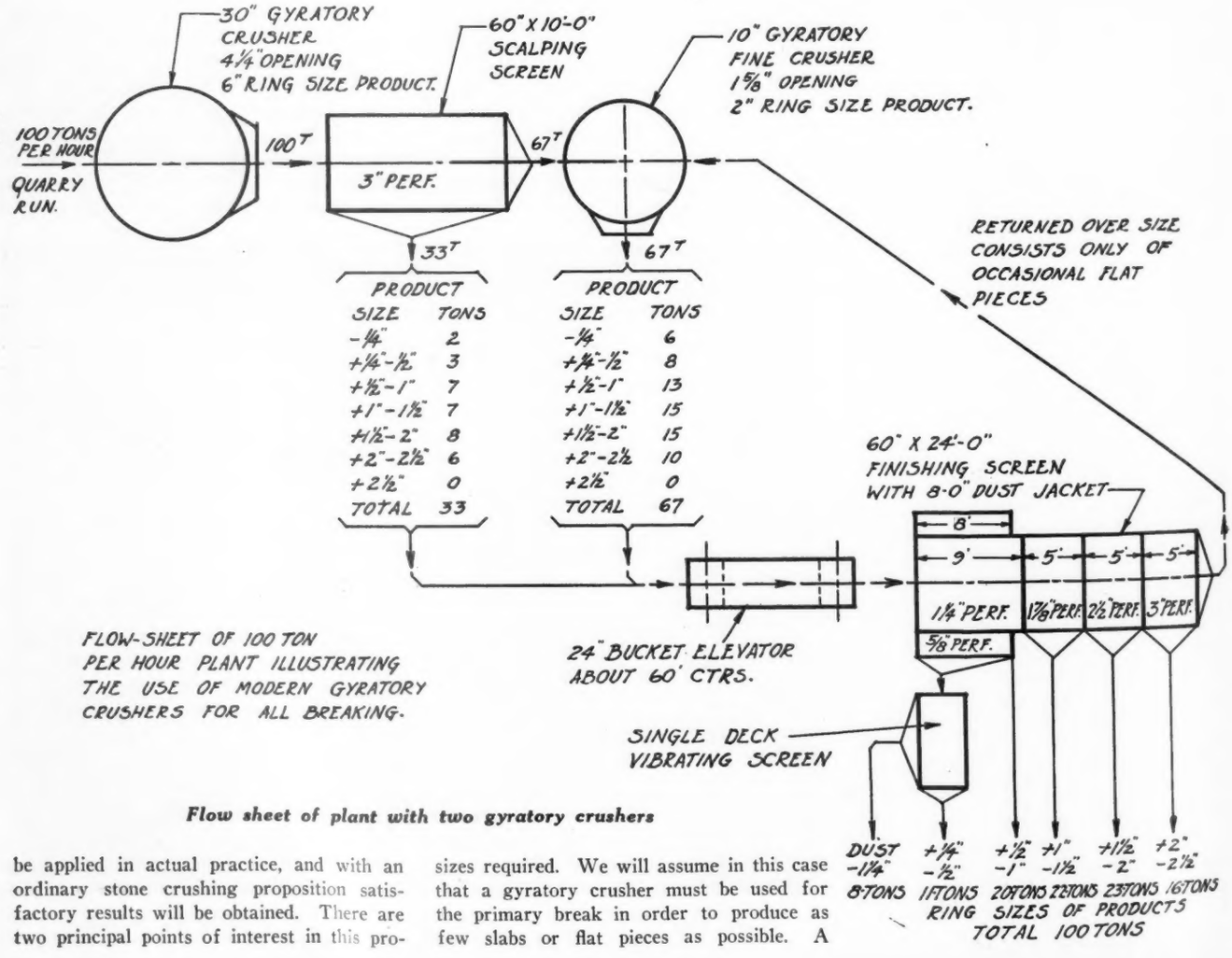
By Hugo W. Weimer
Consulting Engineer, Milwaukee, Wisconsin

TO illustrate that it is possible to obtain similar results in a stone crushing plant by the use of various combinations of equipment, the writer is submitting a second hypothetical layout which can be compared with the proposed layout described in September 18 issue of ROCK PRODUCTS, which has for the primary crusher a jaw type followed by two secondary gyratory crushers. The proposed arrangement as discussed in this article has a gyratory crusher as the primary machine and is followed by a modern type of gyratory fine or reduction crusher for the secondary crushing.

While to some of the readers it may seem that this arrangement is not practical, the writer wishes to give assurance that it can be applied in actual practice, and with an ordinary stone crushing proposition satisfactory results will be obtained. There are two principal points of interest in this proposed layout, one being the proper setting and operation of the primary gyratory crusher and the other the use of the modern type of gyratory crusher (such as is being produced at this time by a number of manufacturers) for fine crushing.

In order that we may have a direct comparison with the plant having a jaw crusher as a primary machine, we will assume the same conditions found for the plant described in the September 18 issue. We will require a capacity of 100 tons per hour of fairly hard limestone which is to be crushed to produce a number of sizes of product ranging in size from dust to 2½ in. ring size, and that the maximum amount of medium sizes is required. The flow sheet lists the sizes required. We will assume in this case that a gyratory crusher must be used for the primary break in order to produce as few slabs or flat pieces as possible. A shovel is to be used in the quarry for loading the cars and therefore, as indicated in the August 21 article, a 1½-yd. dipper will be required for the shovel and the gyratory crusher having a 30 in. opening.

In the design of this plant we are aiming to use only one gyratory for the secondary crusher and this machine is to be of the type capable of producing a large tonnage of a comparatively small size of product, but we must be careful not to have the feed of this secondary crusher of too large a size because the feed openings of fine crushers are comparatively small in relation to their capacity. By referring to the January 23 article we note that a 30 in. gyratory is listed as having a capacity of 220 tons



Flow sheet of plant with two gyratory crushers

per hour when breaking to 5 in. ring size product. It is quite evident that the listed capacity is more than we require, therefore in line with good present day practice we shall either reduce the standard speed of the crusher or reduce the amount of motion of the crushing head. Either one of these changes will reduce the capacity as required, and we will have to determine which would be most desirable.

Since a gyratory crusher, due to its design, crushes continuously without interruption and therefore gives a steady flow to the following machines, it is not so necessary that an apron feeder be used ahead of the primary crusher as is the case when a jaw type is used as the first breaker as described in the September 18 issue. It is desirable that the primary crusher break to as small a size as would be practical, on account of the small feed opening in the secondary crusher. At the same time too great a reduction produces more fine material and dust which is not usually desirable. If we aim at about a 6 in. ring size product from the primary crusher we will undoubtedly obtain a suitable size for the secondary fine crusher, and on this basis we will require a 4¼ in. opening on the open side as specified in the May 29 article. It will be noticed that this is a slightly larger size of product than the minimum as listed for this crusher, therefore we are at liberty to reduce the possible capacity by either changing the speed or the amount of motion of the head. Either method is permissible, but the writer is more inclined to keep the standard speed and reduce the motion of the head. The reason as to why this change will reduce the capacity is fully explained in the January 23 article. In the purchase of this crusher we would therefore require the manufacturer to modify the throw of the eccentric so that at the standard speed we would have a capacity of about 150 tons per hour when having a 4¼ in. opening on the open side of the discharge opening. With this capacity we would still have a safe margin to work on.

Following the primary crusher we will have a scalping screen. It is not always possible to remove all of the finished product by means of a scalping screen, but in this case it is particularly desirable because of the unique arrangement of our secondary crusher. The largest ring size of finished product is 2½ in. and by use of the diagram given in the May 29 issue we find that with a gyratory crusher set to produce 85% of its product to 6 in. ring size or less that 33% is 2½ in. or less and 67% over this size. Thus if we make this division by means of the scalping screen we will have 67 tons per hour passing on to the secondary crusher and 33 tons which will pass through the screen perforations, on to the elevator and then into the secondary screen as a finished product. By referring to the previous articles we find that the scalping screen will be required to be 60 in. diameter with a length of 10 ft. having perforated screen sections with 3 in. round holes.

Having determined on a primary crusher and a suitable scalping screen it is now necessary that we select the proper secondary crusher. Previous articles have illustrated various makes of the gyratory type of fine or reduction crushers, and by referring to the various catalogs we note that they are built in various sizes up to a 20 in. opening. We are reasonably certain from the nature of the material and the size of the primary crusher opening that the maximum size to be delivered to the secondary crusher will not be more than 7 in., therefore a crusher having a 10 in. opening would be suitable, and from the standard listed capacities we note that a 10 in. gyratory fine crusher is given a capacity of about 75 tons per hour with a discharge opening of 1½ in. This is quite satisfactory for our installation, therefore we will decide on the use of a 10 in. size fine gyratory crusher.

TABLE No. 1
To Determine the Length of Each Section in the 60-in. Diameter Finishing Screen

Maximum ring size of feed, inches	Ring size of product, inches	Total tonnage required	Listed capacity per foot of length, tons	Theoretical length of sections required, feet	Practical length of each section, feet
1	½	19	2.6	7.3	8
3	1	20	3.8	5.3	6
3	1½	22	5.2	4.3	5
3	2	23	6.2	3.7	5
3	2½	16	7.1	2.3	5

It is our purpose to produce the maximum tonnage of medium size material, and this being the case, we shall endeavor to set the secondary crusher to such an opening that practically no oversize shall be returned from the finishing screen. From the table and diagram of the May 29 article we note that with a 1⅝ in. crusher opening, 85% of the product will be 2 in. ring size or less and that no piece will be over 2½ in., with a possible exception of occasional flat pieces. This being the case, we shall set the fine crusher as mentioned, especially since it will easily handle the required capacity. The various sizes of product as produced by the two crushers is tabulated on the flow sheet which was obtained from the product diagram of the May 29 article. To convey the material from the scalping screen and secondary crusher to the finishing screen we will use a 24 in. bucket elevator based on the elevator data given in the May 29 article.

The finishing screen will also be 60 in. dia. and the length of the various sections is determined as shown in Table No. 1, which in turn is based on the information given in previous articles. Similar to the plant described in the September 18 article we will use a vibratory screen for separating the dust from the other material. According to the writer's theoretical method of plant layout, we would have no oversize returned from the finishing screen, but, of course, occasionally pieces would pass over the 3 in. perforations, and the layout can be such that this material would be returned to the secondary crusher.

Table No. 2 lists the equipment required for the crushing plant together with the recommendations for the horsepower and speed of motors, assuming that electric power is available, and would be used.

It will no doubt be of interest, now that we have completed this imaginary plant layout, to compare it with the plant having a jaw crusher as a primary machine, as described in the September 18 article. Both plants are estimated for the same capacity and to produce the same sizes of product. As to the horsepower required it will be noted that there is practically no difference, which should clearly illustrate that a certain amount of power or energy is required to perform the work, even if the method of doing same is slightly altered. As to the initial cost of the machinery (not including the installation cost), comparing the jaw crusher layout having a feeder, jaw crusher, two gyratory crushers and a small elevator, with the gyratory crusher plant having one gyratory for a primary crusher and one for the secondary break, it will be found that the cost is about the same, possibly a little in favor of the all gyratory arrangement. As to the installation cost and operating expense, there is no question but that the gyratory layout would be cheaper.

TABLE No. 2
List of Principal Equipment Required for Crushing Plant Only

Item	Motor required H.P.	R.P.M.
30-in. gyratory crusher	125	1200
60-in. by 10-ft. scalping screen	15	900
10-in. gyratory fine crusher	75	1200
24-in. bucket elevator, 60-ft. centers	20	900
60-in. by 24-ft. finishing screen	30	900
Vibrating or shaking screen	5	.....
Total horsepower required	270	

It is not, however, the writer's intention to recommend either layout, as local conditions would govern as to the most suitable arrangement. As previously explained, the intention of this article is to bring before the reader the possibilities and advantages of properly operating the gyratory crusher when used as a primary breaker and also the advisability of using the modern type of fine or reduction gyratory crusher as the secondary breaker in a plant such as illustrated.

Canadian Quartz Production

AN increase in quantity of 46,328 tons and in value of $40,456 is shown for the production of Canadian quartz (silica) during 1925, as compared with 1924, according to finally revised statistics just issued by the mining branch of the Dominion Bureau of Statistics. Shipments of quartz during 1925 reached a grand total of 197,224 tons, valued at $363,612, as compared with 150,896 tons, valued at $232,156, shipped in 1924.

Hints and Helps for Superintendents

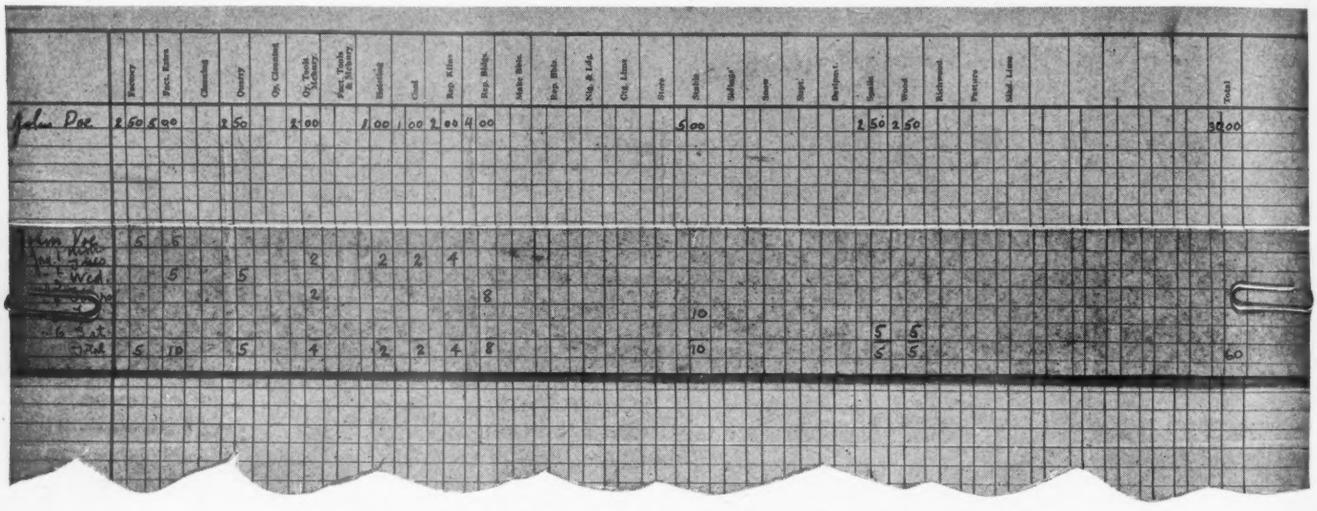
Simple Cost-Keeping Scheme for Lime Plant

THE illustration below shows a simple means of keeping labor costs, especially adaptable to small operations where the proprietor keeps his own cost data. This scheme was devised by John Rich, proprietor of the Swanton Lime Works, Swanton, Vt.

The time of the employes is kept by the foremen of the quarry, lime kilns, cooperage shop, etc. The foreman has a master sheet, showing the various items of operation on which costs are kept. Over this master sheet are fastened by clips strips of ruled paper, seven lines wide (or rather long) so that the working hours of a six-day week may be entered on these slips—there being an individual slip kept for each workman.

The foreman enters only the number of hours worked under each proper heading, and the totals for the week. These slips are turned in to the office and the payroll made up from them. Then, as opportunity permits, Mr. Rich enters the labor costs on his own cost blank, translating the hours worked into dollars and cents as he goes along, using clips to fasten the time slip in its proper place. The total of his weekly labor costs, of course, must check with his payroll.

This is not offered, of course, as the last word in cost-keeping methods, but it does have the advantage of being exceedingly simple to work with, and of keeping the actual cost figures solely in the possession of the general manager or proprietor.



Scheme for keeping labor costs in a simple way—Lime plant operation

End of lever with adjustment for gate opening

Quadrant Gate for Sand Discharge

IT is somewhat difficult to find a good adjustable gate for a sand settling box. Any of the gates that work with sliding plates wear rapidly and most of the other gates leak water and a little sand when they are closed. The gate shown here gives two adjustments of the discharge and a tight closure when it is shut.

A short nipple of pipe is screwed into the bottom of the bin of a size that is according to the discharge wanted. If the pipe nipple is 3 in. or more in diameter the size may be calculated closely enough by figuring that 200 lb. of sand will pass for each square inch of opening. Thus a 3-in. nipple which has an area of 7 sq. in. will pass 1400 lb. of sand per minute. This refers, of course, to sand that is saturated, as it is settled from a stream of water in the ordinary settling box.

A quadrant shaped plate is placed over the end of the pipe nipple. This has two sizes of openings and a blank space which will close the nipple altogether. The quadrant is pivoted on a bolt with a large washer and an iron strap across the quadrant, bolted at the ends to the bottom of the bin, keeps the quadrant tight against the bottom of the nipple. A link made of a rod with flattened ends connects the quadrant with a vertical lever. This connection has a pinned joint (shown in the picture) so that the throw of the the lever may be varied. The pin is placed to where it brings the larger of two holes in the quadrant under the nipple at one end of the lever's motion and the blank space under the nipple at the other end. Putting the lever on the half-way point brings the smaller of the two holes under the nipple.

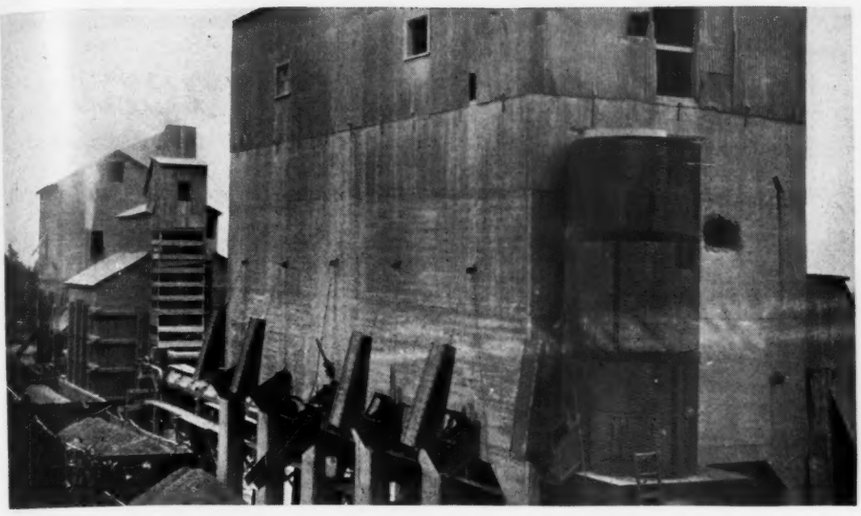
When the sand is running light the smaller hole may be used, which saves the bother of opening and shutting the gate so often. When the sand is running heavy the larger hole can be used, with occasional setting to the smaller hole as the discharge varies.

This device is used at the plant of the Escambia Gravel Corp., Tarzan, Fla.

More on the Deckless Pontoon

SUPPLEMENTING the Hints and Helps published in the August 21 issue on the deckless pontoon in use at the Arkansas River Sand Co., Tulsa, Okla., W. E. Rogers, manager of the company writes:

"In addition to the reasons already stated, the principal advantage of this type of pontoon is in moving them or changing the pipe; that is, they offer the convenience of having the pipe about waist high when the men are standing in the pontoons and allow connections or a lift to be made at greater ease. And it is this convenience both at flood time and when we have many cars in that keeps us using the deckless pontoon."



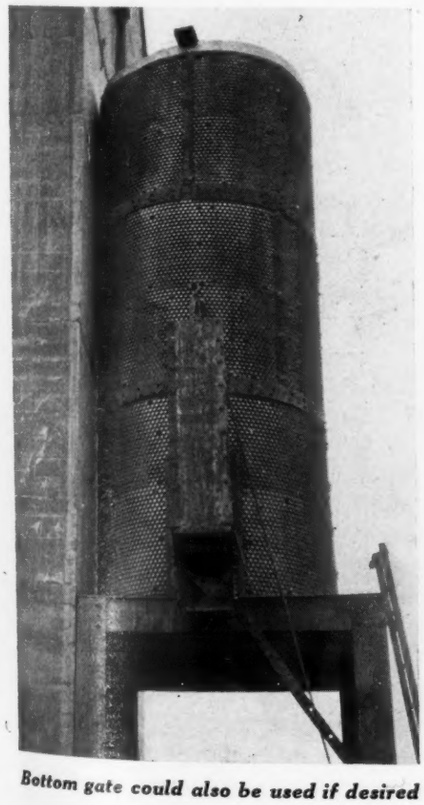
Supplementary bin made of old screen sections

Bin Made of Old Screens

MANY uses for old screen sections have been shown in this department, but perhaps the most unusual is to make a bin of them as illustrated here. This bin was made by Superintendent Stephens of the Dundas plant of the Canada Crushed Stone Corp., Ltd. Readers will perhaps remember him as the inventor of the Stephens belt protector which was described in these pages in the February 23, 1924, issue.

The bin is made simply by fastening the sections together and lining them with galvanized sheets, which would not be necessary where the larger sizes of stone were kept in a small mesh screen section. The platform on which the bin rests was made of second-hand I-beams, bringing the cost of the installation to a low figure.

A side gate and lifting chute are shown with this bin, but a bottom gate might just as well have been used instead.



Bottom gate could also be used if desired

Proper Selection of Rock Drill Lubricants

"THE selection of proper lubricants for rock-drills," says I. M. Marshall in a recent issue of *Engineering and Mining Journal-Press,* "must of necessity be governed by its suitability to meet conditions of use. These will vary with the type of drill used, degree of moisture in the air, pressure, and climatic conditions. The ordinary tests, such as color, specific gravity, and flash and fire test, are of little value. Viscosity and cold test are of the greatest importance.

"Specifications for a drill lubricant should call for an oil of fairly heavy body, not wholly from the viewpoint of lubrication but more from the point of view of economy. An oil too light in body will feed too fast, and either a larger quantity will have to be used to insure proper lubrication or unnecessary wear will result, due to the oil blowing through the machine, leaving the reservoir dry. An oil too heavy in body will not feed fast enough, and the same unnecessary wear will be the result. It is suggested that the viscosity be stated between the limits of 350 and 500 seconds Saybolt at 100 deg. F.

"In warm climates and with high pressures the heavy-bodied oils will be found more satisfactory for drills of simple design; in colder climates the lighter-bodied lubricants of viscosity approaching 350 seconds Saybolt viscometer will be found more satisfactory. In open-pit operation under severe temperature conditions this figure will have to be greatly reduced. As the expansion of air in pneumatic machines produces low temperatures, it is most important that the lubricant should have a good 0 deg. to 5 deg. cold test. It should possess also the following properties: First, that of atomizing well with air; second, of emulsifying with water; third, of being acid-resisting, if mine water is used in the machine; and, fourth, of showing no tendency to stiffen at temperatures near 30 deg. F., in order that the drilling speed may not be reduced. To obtain good emulsifying properties it is desirable that the oil be compounded with an animal, fish, or vegetable oil. Rapeseed oil has been considered the best emulsifier, but, because of its high cost, it is doubtful if an oil compounded with any appreciable quantity of rapeseed can be recommended. Here, price will be a determining factor.

"The physical tests described can be termed indicative, but cannot be considered absolute. The only reliable method of testing a lubricant is to try it in actual practice. If there is any doubt in the superintendent's mind concerning his lubricant, it is suggested that he ask himself the following questions: Is piston or cylinder scouring common? Are rotation part replacements excessive? Do the moving parts of a drill show clean, bright surfaces after days of idleness?

"With the purchase of a suitable oil the problem of lubrication is only half solved. There must be the assurance that there is a continuous flow of oil to the cylinder."

Protecting Pump Motor

ALMOST all pumps used for supplying water to rock products plants have a direct connected motor nowadays. Uusually no trouble is experienced with water getting into the motor, but in some cases water flying from loosely packed joints has wet the motor so badly as to put it out of business.

This happened once or twice in the case of the pump shown here. It was cured by building a light board shield or partition between the pump and the motor. The shaft of the pump and motor passes through the portion near the coupling which acts as a shield over the hole.

Board wall between pump and motor keeps latter dry

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

(These are the most recent quotations available at this printing. Revisions, corrections and supplemental information will be welcomed by the editor.)

Stock	Date	Par	Price bid	Price asked	Dividend rate
Alpha Portland Cement Co. (common)[2] new stock	Oct. 11	No par	37	37	1½% quar. Apr. 3
Alpha Portland Cement Co. (preferred)[2]	Sept. 27	100	115	.....	1¾% quar. Mar. 1
Arundel Corporation (sand and gravel—new stock)	Oct. 11	No par	33⅞	34	45c qu., 15c ext. July 1
Atlantic Gypsum Products Corp. (1st 6's carrying 10 sh. com.)[10]	Oct. 13	.....	111	113	
Atlas Portland Cement Co. (common)[2]	Oct. 11	No par	42	43½	50c quar. Sept. 1
Atlas Portland Cement Co. (preferred)	.....	100	.....	.....	2% quar. Oct. 1
Atlas Portland Cement Co. (preferred)[2]	Oct. 11	33⅓	43	46	2% quar. Oct. 1
Beaver Portland Cement Co. (1st Mort. 7's)[8]	July 29	100	100	100	
Bessemer Limestone and Cement Co. (common)[4]	Oct. 11	100	132	135	1½% quar. Oct. 1
Bessemer Limestone and Cement Co. (preferred)[4]	Oct. 11	100	106½	.....	1¾% quar. Oct. 1
Bessemer Limestone and Cement Co. (convertible 8% notes)[4]	Oct. 11	100	99½	100	8% annual
Boston Sand and Gravel Co. (common)[10]	Oct. 8	100	70	.....	2% quar. July 1
Boston Sand and Gravel Co. (preferred)[10]	Oct. 11	.....	.....	95	1¾% quar. July 1
Boston Sand and Gravel Co. (1st preferred)[10]	Oct. 11	.....	.....	95	2% quar. July 1
Canada Cement Co., Ltd. (common)	Oct. 11	100	107	107¾	1½% quar. Oct. 16
Canada Cement Co., Ltd. (preferred)[11]	Oct. 8	100	115	116	1¾% quar. Aug. 16
Canada Cement Co., Ltd. (1st 6's, 1929)[11]	Oct. 8	.....	102	102¾	J% semi-annual A&O
Canada Crushed Stone Corp., Ltd. (6½s, 1944)[11]	Oct. 8	100	94	96	
Charles Warner Co. (lime, crushed stone, sand and gravel)	Oct. 8	No par	23	25	50c quar. July 12
Charles Warner Co. (preferred)	Oct. 8	100	101	103	1¾% quar. July 22
Charles Warner Co. (lime, crushed stone, sand and gravel) 7s, 1929[18]	Oct. 8	100	102½	103½	
Cleveland Stone Co. (new stock)	Sept. 27	.....	60	67	$1.50 qu. Sept. 1
Connecticut Quarries Co. (1st Mortgage 7% bonds)[17]	Oct. 8	100	104	.....	
Consolidated Cement Corp. (1st Mort., 6½s, series A)[24]	Oct. 13	.....	97	99	
Consolidated Cement Corp. (5 yr. 6½% gold notes)[24]	Oct. 13	100	96	100	
Consumers Rock and Gravel Co. (1st Mort. 7s)[18]	Oct. 9	100	99½	101	
Dolese and Shepard Co. (crushed stone)[7]	Oct. 11	50	88½	91	$1.50 quar. Oct. 1
Egyptian Portland Cement Co. (7% pfd. with com. stock purchase warrants)[21]	Sept. 24	.....	96	100	1¾% quar. Oct. 1
Egyptian Portland Cement Co. (common)[21]	Sept. 24	.....	14	18	40c quar. Oct. 1
Egyptian Portland Cement Co. (warrants)[21]	Sept. 24	.....	10	15	
Giant Portland Cement Co. (common)[2]	Oct. 11	50	55	60	
Giant Portland Cement Co. (preferred)[25]	Oct. 11	50	50	55	3½% s.-a. June 15
Ideal Cement Co. (common)	Oct. 11	No par	68	70	1¾% quar. July 1
Ideal Cement Co (preferred)[6]	Oct. 11	100	106½	109½	$1 quar. July 1
International Cement Corporation (common)	Oct. 11	No par	49½	49⅝	$1 quar. Sept. 30
International Cement Corporation (preferred)[2]	Oct. 11	100	102	102	1¼% quar. Sept. 30
International Portland Cement Co., Ltd. (preferred)	Mar. 1	.....	30	45	
Kelley Island Lime and Transport Co.	Sept. 27	100	130	132	$2 quar. Oct. 1
Lawrence Portland Cement Co.[2]	Oct. 11	100	100	110	2% quar.
Lehigh Portland Cement Co.[6]	Oct. 11	50	86½	89	1½% quar.
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1927 to 1931)[13]	Oct. 9	100	99	100	
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1931 to 1935)[13]	Oct. 9	100	97	98	
Marblehead Lime Co. (1st Mort. 7's)[14]	Oct. 9	100	104	106	
Marblehead Lime Co. (5½% notes)[14]	Oct. 9	100	97	99	
Michigan Limestone and Chemical Co. (common)[6]	Oct. 11	.....	26	.....	
Michigan Limestone and Chemical Co. (preferred)[6]	Oct. 11	.....	24	26	1¾% quar. July 15
Missouri Portland Cement Co.	Oct. 11	25	53½	54	$1 quar. Sept. 30, 25c ex. Sept. 30
Monolith Portland Cement Co. (common)[9]	Oct. 8	.....	11	11½	
Monolith Portland Cement Co. (units)[9]	Oct. 8	.....	27	28	
Monolith Portland Cement Co. (preferred)[9]	Oct. 8	.....	8	8½	
Nazareth Cement Co.[20]	Oct. 8	No par	39½	41½	75c quar. Apr. 1
Newaygo Portland Cement Co.[1]	Oct. 11	.....	107½	120	
New England Lime Co. (Series A, preferred)[14]	Oct. 8	100	.....	95	
New England Lime Co. (Series B, preferred)[22]	Oct. 11	100	92	97	
New England Lime Co. (V.T.C.)[22]	Oct. 11	.....	35	38	
New England Lime Co. (6s, 1935)[11]	Oct. 8	100	99	101	
North American Cement Corp. 6½s 1940 (with warrants)	Oct. 11	100	95¾	96½	
North American Cement Corp. (units of 1 sh. pfd. plus ½ sh. common)[10]	Aug. 14	.....	94	99	2 mo. period at rate of 7%
North American Cement Corp. (common)[10]	Sept. 27	.....	20	22	
North American Cement Corp. (preferred)	Dec. 31	.....	.....	.....	1.75 quar. Aug. 1
North Shore Material Co. (1st Mort. 6's)[15]	Oct. 13	100	99	100	
Pacific Portland Cement Co., Consolidated[5]	Oct. 11	100	61	62	½% mo.
Pacific Portland Cement Co., Consolidated (secured serial gold notes)[5]	Oct. 11	100	96	97½	3% semi-annual Oct. 15
Peerless Portland Cement Co.[1]	Oct. 11	10	7	7½	
Pennsylvania-Dixie Cement Corp. (1st Mort. 6's)[29]	Oct. 13	100	99½	99⅝	
Pennsylvania-Dixie Cement Corp. (preferred)[28]	Oct. 13	100	99	99¼	
Pennsylvania-Dixie Cement Corp. (common)[28]	Oct. 13	.....	43	43¼	
Petoskey Portland Cement Co.[1]	Oct. 11	10	9¼	9¾	1½% quar.
Pittsfield Lime and Stone Co. (2 sh. pfd. and 1 com.)[10]	Sept. 11	.....	.....	225	
Rockland and Rockport Lime Corp. (1st preferred)[10]	Oct. 9	100	105	.....	3½% semi-annual Aug. 2
Rockland and Rockport Lime Corp. (2nd preferred)[10]	Sept. 11	100	.....	.....	3% semi-annual Aug. 2
Rockland and Rockport Lime Corp. (common)[10]	Oct. 9	No par	50	55	1½% quar. Nov. 2
Sandusky Cement Co. (common)[1]	Sept. 27	100	118	130	$2 quar. Oct. 1
Santa Cruz Portland Cement Co. (bonds)[5]	Oct. 11	.....	105½	106	6% annual
Santa Cruz Portland Cement Co. (common)[5]	Oct. 11	50	79	85	$1 quar. $1 ex. Dec. 24
Superior Portland Cement, Inc. (Class A)[20]	Oct. 8	.....	42¾	43½	
Superior Portland Cement, Inc. (Class B)[20]	Oct. 8	.....	20½	21½	
United Fuel and Supply Co. (sand and gravel) 1st Mort. 6s[27]	July 16	100	98	100	
United Fuel and Supply Co. (sand and gravel) 6% gold notes[27]	July 16	100	96	99	
United States Gypsum Co. (common)	Oct. 11	20	147	147½	2% quar., $1 ex. Sept. 1
United States Gypsum Co. (preferred)	Oct. 11	100	118	118	1¾% quar. Sept. 30
Universal Gypsum Co. (common)[3]	Oct. 11	No par	12	13	
Universal Gypsum V.T.C.[3]	Oct. 13	No par	11½	12½	
Universal Gypsum Co. (preferred)[3]	Sept. 15	.....	70	73	1¾% quar. Sept. 15
Universal Gypsum and Lime Co. (1st 6's, 1946)[3]	Oct. 13	100	96	.....	
Union Rock Co. (7% serial gold bonds)[18]	Oct. 9	100	99	101	
Wisconsin Lime and Cement Co. (1st Mort. 6s, 1940)[15]	Oct. 13	100	98½	100	
Wolverine Portland Cement Co.	Oct. 11	10	6½	6½	2% quar. Aug. 1

[1]Quotations by Watling, Lerchen & Co., Detroit, Mich. [2]Quotations by Bristol & Willett, New York. [3]Quotations by True, Webber & Co., Chicago. [4]Quotations by Butler, Beading & Co., Youngstown, Ohio. [5]Quotations by Freeman, Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]Quotations by F. M. Zeiler & Co., Chicago, Ill. [8]Quotations by Ralph Schneeloch Co., Portland, Ore. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee. Higginson & Co., Boston and Chicago. [11]Nesbitt, Thomson & Co., Montreal, Canada. [12]E. B. Merritt & Co., Inc., Bridgeport, Conn. [13]Peters Trust Co., Omaha, Neb. [14]Second Ward Securities Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois, Chicago. [16]J. S. Wilson Jr. Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hemphill, Noyes & Co., New York. [20]Quotations by Bond & Goodwin & Tucker, Inc., San Francisco. [21]Baker, Simonds & Co., Inc., New York. [22]William C. Simons, Inc., Springfield, Mass. [23]Blair & Co., New York and Chicago. [24]A. B. Leach and Co., Inc., Chicago. [25]A. C. Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [27]J. G. White and Co., New York. [28]Mitchell-Hutchins Co., Chicago, Ill. [29]National City Co., Chicago, Ill.

QUOTATIONS ON INACTIVE ROCK PRODUCTS CORPORATION SECURITIES ON PAGE 76

Editorial Comment

The Plasticity of Limes

Finishing lime, that is, lime for finish-coat plaster, must be plastic and it must be white. Numerous limes in various parts of the country can be used for finish-coat work, when hydrated on the job with proper care and manipulation, or when made into lime putty and properly aged. Very few of these limes are good enough in plasticity when prepared as commercial hydrates to be used as finishing lime. Consequently a white lime that will make a plastic hydrate is a commodity of national distribution. Such a commodity is the famous Ohio dolomitic lime hydrate, and its distribution is actually national in scope.

The problem of finding out what makes Ohio dolomites give plastic hydrates, when other dolomites of practically the same chemical analysis resist all attempts to make hydrates of equal plasticity, has been tackled by many experimenters and investigators. Their findings are as various, almost, as their experiments. The secret of plasticity that makes Ohio dolomitic lime putty "spread like warm butter" has been attributed to "soft-burned" magnesia, to a small content of the element strontium, and to many other things.

Now come two college professors who put before them this problem thus stated: "What are the chemical reasons for the peculiar characteristic properties of finishing hydrates?" Under Prof. Frank C. Mathers, head of the department of chemistry, Indiana University, H. T. Briscoe made that the subject of his thesis for the degree of doctor of philosophy—which, by the way, he has been granted.

In his experimental work on different dolomitic limestones Dr. Briscoe burned many samples in small crucibles in gas flames. In the case of the Ohio dolomites it was found that a salt was volatilized and deposited on the lid of the crucible. Dolomites from other sections of the country do not give this salt deposit, or at least give very little of it. This salt proved to be sodium chloride, or ordinary salt.

One result of this discovery is the patent, issued to Prof. Mathers (printed in full in Rock Products, August 7, pp. 47, 48) for a process of calcining a dolomitic limestone to which salt has been added. This process, it is claimed, will result in a lime, which when hydrated in the ordinary commercial way, will produce a dry hydrate, that made into putty, has a plasticity equal to the putty of the Ohio dolomitic hydrates.

The article referred to in Rock Products, according to Prof. Mathers, has resulted in awakening widespread interest in the lime industry. In justice to Prof. Mathers and to the National Lime Association, it should be made clear to the lime industry that while Prof. Mathers several years ago did some research work for the association, all his recent work, and this work on the plasticity of hydrates, have been done entirely independent of the association. This explanation is desirable because the problem of making all limes plastic is one of those problems which could not be taken up co-operatively by the lime industry at the present time, for reasons that are obvious to those familiar with the lime industry.

In publishing a description of Prof. Mathers' process we mentioned the fact that he had done research work for the National Lime Association, but it was not our intention to infer that the work described had anything to do with the association. However, we cannot refrain from recalling editorial comments in issues long past, in which we reiterated again and again that one result of association research inevitably must be an awakening of interest on the part of scientific men in the problems of lime manufacture, and the very probable instigation of independent research work which would have far greater results commercially than any research work that the association itself might do.

The lime industry offered a practically virgin field for just such independent research work—and already we see interesting developments as a result of this interest in lime awakened in scientific men by the research work of the National Lime Association. We confidently believe that we are far from seeing the fruit of the association's research efforts, even though these efforts were to cease tomorrow. And it indeed speaks well for the National Lime Association that it has created this growing interest in lime—for that must ever be its primary function.

Whatever may be the immediate effect of Prof. Mathers' discovery on the Ohio finishing lime business we do not believe it is going to have any other ultimate effect on Ohio dolomitic lime manufacturers than to open the door to them for other and far more important discoveries about dolomitic limes, by which they will profit in proportion to their ability to use such discoveries. As we have said again and again dolomite offers one of the most fascinating subjects for research. The whiteness and plasticity of its lime are valuable attributes, and there are possibilities, probabilities, that it can be made into hydraulic lime stuccos that will have a far greater market than finishing lime.

Vision is needed for research work. Those who engage in it co-operatively with the certainty that results will sooner or later become public property, must have not only the vision to see that discoveries may sometimes result temporarily in upsetting things now established, but they must have the courage to meet such results, and they must have the vision to see beyond and the breadth to realize that *all* advances in knowledge must ultimately be for the good of the industry.

QUOTATIONS OF INACTIVE ROCK PRODUCTS SECURITIES

Stock	Date	Par	Price bid	Price asked	Dividend rate
Coplay Cement Mfg. Co. (common) (4)	Dec. 16	.....	12½	.....	
Coplay Cement Mfg. Co. (preferred) (1)	Dec. 30	.....	70	.....	
Eastern Brick Corp. 7% cu. pfd.) (1)	Dec. 9	10	40c	.....	
Eastern Brick Corp. (sand lime brick) (common) (1)	Dec. 9	10	40c	.....	
Edison Portland Cement Co. (common) (4)	Sept. 11	50	20c	.....	
Edison Portland Cement Co. (preferred)	Nov. 3	50	17½c(x)	.....	
Iroquois Sand & Gravel Co., Ltd. (2 sh. com. and 3 sh. pfd.) (1)	Mar. 17	.....	$12 for the lot	.....	
Lime and Stone Products Co. (1100 sh. pfd., $10 par and 700 sh. com., $10 par)	Feb. 10	.....	$66 for the lot	.....	
Missouri Portland Cement Co. (serial bonds)	Dec. 31	.....	104¾	104¾	3¼% semi-annua.
Olympic Portland Cement Co. (g)	Oct. 13	.....	.....	£1⅝	
Phosphate Mining Co. (1)	Nov. 25	.....	1@5	.....	
River Feldspar and Milling Co. (50 sh. com. and 50 sh. pfd.) (1)	June 23	.....	$200 for the lot		
Rockport Granite Co. (1st 6's, 1934) (2)	Aug. 31	.....	90	.....	
Simbroco Stone Co. (pfd.)	Dec. 12	.....	.....	.....	$2 Jan. 1
Southern Phosphate Corp. (6)	Sept. 15	.....	1¼	.....	
Vermont Milling Products Co. (slate granules) 5 sh. pfd. and 1 sh. com. (3)	Dec. 30	.....	$1 for the lot	.....	
Wabash Portland Cement Co. (1)	Aug. 3	50	60	100	
Winchester Brick Co. (preferred) (sand lime brick) (5)	Dec. 16	.....	10c	.....	

(g) Neidecker and Co., Ltd., London, England. (1) Price obtained at auction by Adrian H. Muller & Sons, New York. (2) Price obtained at auctio by R. L. Day and Co., Boston. (3) Price obtained at auction by Weilepp-Bruton and Co., Baltimore, Md. (4) Price obtained at auction by Barnes and Lofland, Philadelphia, Pa. (5) Price obtained at auction for lot of 50 shares by R. L. Day and Co., Boston, Mass. (x) Price obtained at auction by Barnes and Lofland, Philadelphia, on November 3, 1925. (6) Price obtained at auction by Wise, Hobbs and Arnold, Boston, Mass.

Dewey Portland Bonds Offered

CHICAGO TRUST CO. and Hitchcock and Co., Chicago, Ill., are offering at prices to yield from 5.50 to 6%, dependent on maturity, $2,000,000 first mortgage 6% serial gold bonds, series A of the Dewey Portland Cement Co, Dewey, Okla., and Davenport, Iowa. Bonds to be retired in increments of $50,000 annually from 1928 to 1941 and the remainder, $1,300,000, on April 1, 1942.

Interest payable April 1 and October 1 at the Chicago Trust Co., Chicago, or Bankers Trust Co., New York, without deduction for normal federal income tax not to exceed 2%. Callable on any interest date upon 60 days' notice at 103½ except that the premium in no case shall exceed ½ of 1% for each unexpired year of the life of the bond called. Authorized: $2,500,000. Outstanding: $2,000,000. Coupon bonds registerable as to principal only. Denominations $1,000, $500 and in 1942 maturity, $100. Chicago Trust Co. and Willard F. Hopkins, trustees.

History of Business.—The Dewey Portland Cement Co., incorporated in 1906, has its main office in Kansas City, Mo., and owns and operates a portland cement plant in Dewey, Okla. The present plant has a productive capacity of 1,500,000 bbl. a year, and is shipping principally to Oklahoma, Kansas, Nebraska, southern Missouri, Arkansas, Louisiana and Texas.

Purpose of the Issue.—The proceeds of this bond issue will be used for the erection of a modern wet process portland cement plant a few miles west of Davenport, Iowa, where real estate is now owned by the company. This new plant will have a productive capacity of about 1,000,000 bbl. of cement a year, and ship principally to Iowa, Illinois, Wisconsin, Minnesota, northern Missouri, Nebraska, North Dakota and South Dakota.

Capitalization.—The following table lists the authorized and issued stock:

Capitalization	Authorized	Issued
Preferred stock	$1,000,000	$ 506,900
Common stock	1,000,000	1,000,000
First mortgage 6s	2,500,000	2,000,000

Security.—These bonds are secured in the opinion of counsel by a first mortgage on all of the land, buildings and equipment of the company, including the new plant. The appraised value of the Dewey plant as determined by J. C. Buckbee Co. is $3,541,965; the Davenport plant will cost about $2,100,000; making a total value of plant and equipment of $5,641,965. Net current assets are $1,176,210.

Earnings.—The company's earnings for the past four years, as certified by Messrs. Hart and Bauer, certified public accountants, have been as follows:

	Gross sales	Profit before depreciation and depletion	Net profits*
1922	$1,724,712	$589,770	$358,329
1923	1,882,215	583,824	354,108
1924	1,844,193	457,573	336,201
1925	2,033,621	539,907	414,453
1926 (6 mo. June 30)	942,684	319,500	217,686

*After depreciation and depletion available for interest.

Average net earnings for the past four years available for bond interest of $120,000 have been $365,773 or over three times interest charges. The net earnings of the combined properties after completion of the Davenport plant should be in excess of five times bond interest charges.

Sinking Fund.—The trust indenture provides that a sinking fund shall be created amounting to 20% of the net earnings of the company for the preceding calendar year, computed after all charges except federal income tax. Such 20% shall be applied first to the retirement of the series of bonds due the subsequent year and if not obtainable or in excess of that amount, to bonds of the last maturity by purchase in the open market or by call.

BALANCE SHEET JUNE 30, 1926
(After Financing)

Assets—	
Fixed assets	$3,092,199
Cash	437,903
Accounts and notes receivable	203,440
Inventories (at cost or market)	430,533
Loans and advances	50,664
Deposits on bids (returnable)	500
Investments (at cost)	194,936
Deferred charges	103,555
Total	$4,513,730
Liabilities—	
Preferred stock	$ 506,900
Common stock	1,000,000
First mortgage 6s	2,000,000
Accounts payable	51,841
Accrued wages and taxes	89,924
Surplus to cover liability claims	66,274
Undistributed profits	798,791
Total	$4,513,730

Officers.—Frank E. Tyler, Pres. & Gen. Mgr.; H. F. Tyler, 1st V.-Pres.; R. W. Moore, V.-Pres. & Sec.; Walter Gray, Sales Mgr.; D. M. Tyler, V.-Pres. & Asst. Gen. Mgr., and W. E. Tyler, V.-Pres. & Treas.

Dexter Portland Bonds Called

ALL the outstanding first mortgage 6% serial gold bonds of the Dexter Portland Cement Co. dated December 15, 1925, and due in 1935, have been called for redemption on November 1 at 103 and interest. Empire Trust Co., 120 Broadway, New York City, is the trustee. (For details of offering see ROCK PRODUCTS, January 23 issue, p. 60.)

Fiborn Limestone Deficit

THE Fiborn Limestone Co., subsidiary of the Agloma Central and Hudson Bay railroad, reports a deficit of $4,896 for the year ended June 30, 1926. The net earnings for the 6 months amounted to $7,970 after depreciation charges, etc., of $12,866. Previous deficit reported amounts to $81,045 which added to that for the present year, gives a total of $85,941. Deficit in 1924-25 was $9191.

International Cement Third Quarter Expected to Show Good Gain

THOSE familiar with the International Cement Corp. believe that the company will make a somewhat better showing in the third quarter than was reported in the second quarter of the current year. Estimates place the net at approximately $1,300,000, or nearly $2 a share, on the 562,500 shares of common stock, compared with net earnings of $1,058,786, or $1.77, in the quarter ended June 30. In the third quarter of 1925 International showed net of $1,352,800, or $2.35, on 500,000 shares common outstanding.

With probable earnings of around $3,100,000 in the first nine months of 1926, the full year's common dividend will be earned with upward of another dollar on the common stock. For the full year conservative estimates place net earnings at around $3,900,000, or better than $6 a common share. In 1925 net earnings amounted to $3,976,385, or $7.03 a common share.

The present expansion program represents the second part of a two year program, the Indiana and Alabama Portland cement companies having been purchased in 1925. All acquisitions and construction on the part of this company have been done without funded debt or bank loans and the present $5,000,000 program is being financed 40% through earnings and 60% through sale of 62,500 additional common shares of stock.

The net property and plant values are carried on the books at about $2.30 per barrel, which is considered low. Of this value of $2.30 per barrel less than 70 cents is represented by securities senior to the common. The common stock possesses a 75% equity in net profits.—*Wall Street News.*

Agstone Men Meet With New York Producers

New Eastern States Limestone Association Formed and Joins National Agstone Association

THE National Agstone Association held a special meeting at the Statler hotel in Buffalo, N. Y., on Sept. 30. The purpose of the meeting was to explain to New York producers the advantages of belonging to the national association and to give them a resume of what the association had already accomplished. President L. E. Poorman, of the France Stone Co., Toledo, Ohio, explained this as soon as he had called the meeting to order and then introduced J. C. King of the Carbon Limestone Co., Youngstown, Ohio, as the oldest member, one who was perhaps best acquainted with the association's work.

History of the Association

Mr. King told of the founding of the association at Columbus, Ohio, 10 years ago. The stability of the industry is best observed, he said, when it is noted that all the charter members present at that first meeting are still represented in the association. A wise policy adopted at the first meeting was that of holding regular monthly meetings. This made it possible to carry out work while the enthusiasm for it was strong and the purposes still fresh in the minds of the members.

The states represented at the first meeting were Ohio, Indiana, Pennsylvania and New York, although the greater number came from Ohio. Hence the association was given a national status although its work was largely confined to the problems of Ohio. But it had served as a nucleus for national work and it had been a model for the formation of other associations with headquarters in North Carolina, Texas, Wisconsin, Illinois, on the Pacific coast and other places. He hoped that the New York producers would organize and affiliate with the National Association as these other associations had done at least in part.

Educating the Farmer to Use Limestone

The purpose of organizing was of course to increase the demand for agricultural limestone as its benefits were by no means as well understood by the farmers of the country at that time as they are today. Agricultural stations and farm bureaus had taught something of the need of liming but the association was needed to broadcast that work and to bring it to the attention of the farmers more effectively than bulletins and similar publications were doing.

Many schemes were tried out in Ohio to educate the farmer in the benefits of liming. One of the first was, naturally, to carry on an advertising campaign in the farm papers and local papers of the state. This had been found expensive and not particularly effective in promoting sales. The arguments in favor of using agstone were somewhat weakened by the evidence that the purpose of the advertisements was to sell something.

Leo E. Poorman, president, National Agstone Association

It was found that the money would go a great deal farther in working through county agents and agricultural schools. Those in charge of such institutions were already "sold" on the value of liming and were quite ready to co-operate in educational work, knowing its real benefit to agriculture in the state. From Dr. Bear, the head of the agricultural department of the state university, they got an estimate of the amount of liming material needed each year in Ohio, which was from 2,000,000 to 3,000,000 tons. This gave them a sizable mark to shoot at.

While they were a long way from supplying the full needs of Ohio, the record showed that much progress had been made. The amounts of liming material applied in each year from 1920 on were:

	Tons
1920	118,925
1921	97,951
1922	149,054
1923	170,052
1924	212,371
1925	236,015

The record for 1926 would have exceeded that of 1925 if it had not been for the early rains which prevented the farmers from getting on the fields at the time when the most liming was usually done. This increased use of lime could be largely traced to the educational work of the association.

Illinois Farmers Quick to Realize Value of Liming

The experience of Illinois was even more illustrative of what could be done by education of the right sort. The producers of Illinois got together and worked through farm bureaus, the Grange and other groups. These Illinois producers had large quantities of "screenings" of the sort known in Ohio as limestone meal as a by-product of stone crushing. They put a low price—50 cents a ton—on these and sold through these farm groups. So effective was this method that they raised the sales from agricultural limestone from 200,000 tons in 1920 to 750,000 tons in 1925.

The demand for agstone in Illinois grew with its use. One of the principal producers of the state, the speaker said, had found it impossible to supply the new demand. This producer had raised the price from 50 to 75 cents a ton and taken off his salesmen and was still 10,000 tons behind in his orders on August 1.

Study on Standardization of Sizes

Early in the history of the association the question of fineness came up. No one knew where the economical point at which grinding, or pulverizing, should be stopped. The producers wanted just what the farmers wanted, that is to get the best liming of the land at the least cost, and it was evident that money spent in grinding finer than was necessary was money wasted. It would be possible to standardize on sizes as soon as the effect of fineness could be known.

So the association went to Dr. Bear and asked him what it would take to settle this point. He said, after thinking it over, that it would require 10 years time and $10,000 with which amount an agricultural limestone chair in the college could be endowed. The association pledged the money and work was begun under the direction of Professor Broughton of Maryland, in connection with the soils department of the university. He

was followed by Professor Kriege, who came from Iowa, and lately by Professor Allen, who came from Tennessee. These men had discovered things about liming soils that were never known before and their work had made them internationally famous.

It was too soon for full conclusions to be reached, but at present it looked as though only two grades of limestone would be needed, one which would be all through ¼-in. and 30% through 100-mesh and another which would be all through 10-mesh and 40% through 100-mesh. Burned lime, it appeared, would always be used and so would "plant lime," the precipitated by-product of certain chemical plants. But there is no need of offering the farmer a choice of a dozen or more different grades of fineness.

When agstone began to be used in this country it had to be ground very fine because it had to compete with burned lime. The use of lime on the soils is very old; the Chinese used it 2000 years before the Christian era. When lime first began to be applied in this country the farmers burned the stone because that was the only method they had of pulverizing it. The machinery for grinding and pulverizing stone economically was not even invented at that time. The use of burned lime and hydrated lime was so firmly fixed that limestone had to be ground fine, or else the users would not even consider it. But now the tendency was toward applying a coarser product that would disintegrate more slowly and hence have a more lasting effect. What is necessary to know at the present time is just how far to go in the matter of a fine product. This is what the experiments carried on in Ohio are to determine and the results will be of immense benefit not only to the producers of limestone, who are paying for them, but to the agricultural industry everywhere.

This, said Mr. King, is just a part of the work that the National Agstone Association is doing, and it is work in which the cooperation of the limestone producers of New York state is invited.

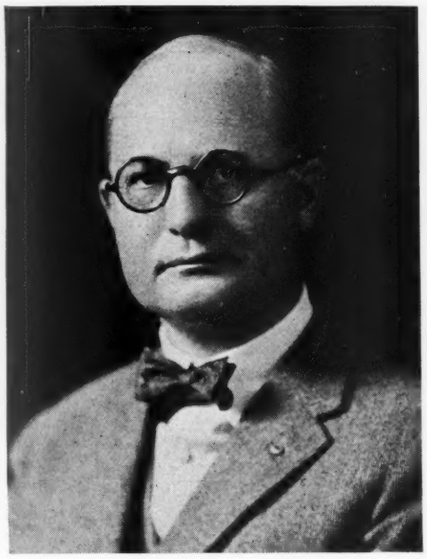
Monthly Library Research Reports from Ohio

President Poorman followed Mr. King with some details on the test work to which he had referred. The results were all to be published in a form that would be easily understood by the non-technical man and illustrated with maps and charts.

Mr. Poorman wished to call attention to the library research reports issued by the Ohio group each month. These are prepared by one of the senior students who is taking an agricultural course. He reads the agricultural papers and new books and abstracts, everything that seems of interest to those who produce and those who use liming materials. This is edited by one of the professors and then sent out in the form of a monthly bulletin. (Mr. King read some excerpts from the current issue.) The magazine *Better Roads* (published by the Ohio Crushed Stone Association, has been generous with its allotment of space to agricultural limestone and carries four or five pages in practically every issue.

New York Producers Adopt European Standards of Fineness

N. G. Farber, of the Michigan Limestone Co., Buffalo, N. Y., said that the New York producers had completed the preliminaries of organization and he would call on George



J. C. King

T. Simmons of the F. E. Conley Stone Co., who was to be the president of the new association, for some explanation of its purposes.

Mr. Simmons said the new organization wanted to get started right and were willing to learn of those who had been longer engaged in association work. The F. E. Conley Co. had been making and selling pulverized limestone since 1909. They had followed the work of Joseph Wing of Ohio and of Cyril Hopkins of Illinois in making and recommending their product. For this reason they had ground to 10-mesh and thought that was fine enough. The Germans had been longer at the business than anyone. They began grinding limestone in 1880 and ground it very fine. Then they decided that this was a mistake and ground very coarse. But in 1910 they had settled on 10-mesh grinding as fine enough and this conclusion had also been reached by most of the producers in England, France and Belgium.

It was his belief that the farmers of the country would buy a lot more lime if they could buy it cheap enough or if it could be proved to them that they were buying fertility that would extend over a long period.

Mr. Poorman then brought up the question of freight rates, and said that it was extremely probable that the railroads would make an effort to raise the rates on agricultural limestone in the next two or three years. This was one of the matters in which the producers must act as an association if they were to get anywhere at all. He also spoke of the warnings issued by the railroads that open-top cars would soon be scarce and said that car shortages were another matter that the association could handle better than individual producers.

Mr. King explained how the rates had been fixed at 60% of the fifth class rate. The association had convinced the railroads that a low rate would benefit the farmers and give an increased back haul in the form of added farm products. He also explained the different rate making bodies, the local boards, the Central Freight Association and the Interstate Commerce Commission and the part played by each. It was his opinion that while an effort to raise rates on agricultural limestone would eventually be made, but that such a move would not come for two years.

Promoting a Strong National Body

The latter part of the morning session was given up to discussing organization methods. President Poorman said that at the coming convention of the National Crushed Stone Association, to be held at Detroit, the work already begun at the Montreal and earlier conventions would be carried farther. It was hoped that all the local associations might be welded into a strong national body with regional vice-presidents from the different groups. It had been conclusively shown that there are many things which only a national organization can handle effectively, for example, freight rates. The Interstate Commerce Commission and the Central Freight Association have not the time to listen to individual producers. They can only consider protests and petitions that come from groups large enough to represent the industry as a whole.

Among the other speakers of the morning was H. O. Pierce of the Solvay Process Co., Syracuse, N. Y. Mr. Pierce said that while the allied companies which were represented were interested in a great many products, he felt sure they would be strongly behind any program of education that would increase the demand for agricultural limestone.

C. W. Fuller of the Columbia Products Co., Cleveland, Ohio (which is a subsidiary of the Pittsburgh Plate Glass Co.), was asked to tell what "plant lime" was and how it was made. He explained that in the manufacture of certain alkalis lime was burned to make both quicklime and carbon dioxide gas. In a part of the process the carbon dioxide was added to a solution which contained lime and the lime was precipitated as calcium carbonate, the same thing as limestone but artificially prepared. It was very finely divided and "fluffy," a 50 lb. bag having almost twice the dimensions of an 80 lb. bag of pulverized limestone. For this reason it went into solution easily when it was applied to the land.

At luncheon a discussion began as to how

to increase the demand for liming materials in the off season, especially in the fall. It was suggested that the farmers might be induced to lime land already plowed and even that which had been sowed to wheat. Mr. King said this would not do. The farmers could not use lime spreaders on fields that were furrowed from plowing and they would not track up their wheat fields. It was then suggested that the farmers might want to lime sod land that was afterward to be plowed. This had given good results in some instances where the sod land was to be put in corn, but Mr. King thought as a general rule the practice was not successful. Plowing turned the sods on edge and put the lime too deep in the ground.

Liming Plowed Soil in Winter

Very good results had come from liming land that was to be plowed while covered with snow. The melting snow carried the lime down into the soil and left it where it was needed.

Methods of increasing the sale of liming materials in the off season by post dating and the offering of discounts were discussed by a number of members. No special conclusions were reached, but it was pointed out out by one speaker that post dating was expensive, as not only the cost of making the product but often the advanced freight had to be carried for some months. Another speaker brought out that a discount to be effective must mean enough of a saving to induce a farmer to haul the lime from the railroad at a time when he might be busy with other matters. The ordinary farmer used about 10 tons of lime per year. A saving of a few cents a ton on such a quantity would hardly induce him to leave other work to haul lime.

N. G. Farber said that so far as liming sod was concerned, he had known liming to have an excellent effect where the ground was put in oats or corn and the sod rotted well.

The matter of how fine agricultural limestone should be to be most effective is apparently a topic which agstone men are always willing to discuss and it came up again in the talk around the luncheon table. President Poorman gave some results obtained by ordinary limestone meal, all through ¼-in. obtained on alfalfa fields in which there were yellow spots due to acidity of the soil. Two weeks after the limestone had been applied these spots had disappeared.

E. M. Lamkin of the Kelley Island Lime and Transport Co., Cleveland, Ohio, also spoke in favor of the use of coarser products. The question of leaching was all important from the farmers' point of view and the coarser products by their slower disintegration held back the leaching and allowed a constant correction of the acidity over a long time. As producers they should remember that tonnage was an important factor in their business. It might be better to produce a coarser material which could be made at less cost because they could sell more of it. And he referred to the success of Illinois producers who had disposed of such large tonnages by working along those lines.

He also said he would like to see the business developed to where more of the product could be sold as it was made. It cost considerable money to put limestone into storage piles and reload from these to cars, and the price to the user had to be made to cover that expense. If it were possible to sell more limestone as it was produced it might be reasonably supposed that the price to the consumer could be lowered proportionately and a greater tonnage could be sold. No one could say just where the line lay beyond which a lowered price would greatly increase sales and it might be that reducing the cost of manufacture, even in a slight degree, would permit sales to be made in considerable excess above present demand.

New York Producers Organize

After luncheon the New York producers retired and completed their work of organization, while the others gathered in the meeting room and discussed matters connected with soil liming in an informal way. At the end of an hour the New York producers appeared and N. G. Farber reported that they had decided to form an association which would be known as the Eastern States Limestone Association. It had also been voted to affiliate with and hold a membership in the National Agstone Association. The officers of the new association he reported were:

President, G. T. Simmons, of the F. E. Conley Stone Co.; vice-president, E. S. Bixler, of the Limestone Products Co. (Newton, N. J.); treasurer, O. W. Jayne, of J. Langdon and Co., and secretary, F. G. Thompson, of the Michigan Limestone Co. Mr. Bixler was the only one of these who was not present. The report was received with a good deal of satisfaction by the other members who gathered around the New York men to shake hands with them and congratulate them.

There was some discussion as to where the next meeting was to be held. The date was set for the first Thursday in November and the place, probably, at Chicago. Before finally deciding to meet in Chicago the secretary was asked to communicate with associations in Wisconsin, Illinois and Indiana to see if enough of their members were willing to be present so that the meeting would represent those states as well as Ohio, New York and western Pennsylvania.

Those who were present at the Buffalo meeting are:

L. E. Poorman, president of the association, France Stone Co., Toledo, Ohio.

W. H. Margraf, Marble Cliff Quarries Co., Columbus, Ohio.

N. G. Farber and F. G. Thomson, Michigan Limestone Co., Buffalo, N. Y.

H. O. Pierce and J. H. Kaiser, Solvay Process Co., Syracuse, N. Y.

J. C. King and M. Z. Bentley, Carbon Limestone Co., Youngstown, Ohio.

C. W. Fuller and W. W. Bolton, Columbia Products Co., Cleveland, Ohio.

E. Gilbert, New Castle Lime and Stone Co., New Castle, Penn.

Edgar M. Lamkin, Kelley Island Lime and Transport Co., Cleveland, Ohio.

O. W. Jaynes, J. Langdon and Co., Elmira, N. Y.

Geo. T. Simmons, F. E. Conley Stone Co., Utica, N. Y.

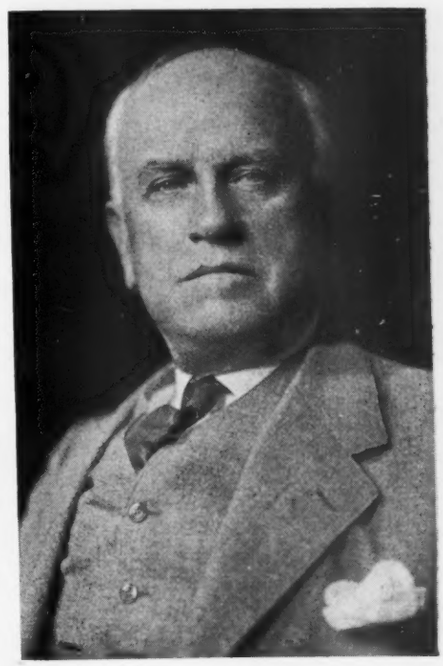
Edmund Shaw, Rock Products, Chicago.

Low Grade Bauxite Possibilities

AN investigation having in view the devising of methods of beneficiating low grade bauxite so as to make deposits of such bauxite commercially available is being undertaken at the southern experiment station of the Bureau of Mines, Department of Commerce, Birmingham-Tuscaloosa, Ala. A large number of low grade bauxite deposits occur in the states of Alabama, Georgia, Mississippi, and Tennessee, but only a small proportion of these deposits have been exploited so far, on account of the excessive quantities of impurities with which the bauxite is contaminated. The impurities are principally silica, iron and titanium, and the main purpose of the investigation will be to find, if possible, some satisfactory way of eliminating these impurities.

Col. C. W. S. Cobb Retires as Active Head of Glencoe Co.

FOR 37 years, since the Glencoe Lime and Cement Co., St. Louis, Mo., was founded, Col. C. W. S. Cobb has served as its president. He is now retiring as active head to become chairman of the board of directors, a newly created office.



Col. C. W. S. Cobb

E. S. Healy has been elected president and G. H. F. Johannes first vice-president.

Anniversary of Inauguration of Crushed Stone Research Duly Celebrated

October Meeting of New York State Crushed Stone Association the Best Attended in the History of the Organization

ON October 1 the regular monthly meeting of the New York State Crushed Stone Association was held at Le Roy, N. Y., at the hunting lodge of J. L. Heimlich. About a year ago the association held its meeting at the same place, and that meeting made history for the crushed stone industry. At that time the preliminary work of raising money to support a research bureau of the national association was begun. President Graves of the National Crushed Stone Association was present and made a speech which convinced the members of the necessity of engineering research if the crushed stone industry was to progress, and there followed pledges by the representatives of the various companies present for their share of the necessary cash to institute and carry on the work—the real starting point of actual accomplishment.

Among those who were present on that historic occasion was one whose recent death has left a genuine sense of personal loss—F. W. Schmidt, of the Morris County Crushed Stone Co. and the Buffalo Crushed Stone Co. Many of those who attended the recent October meeting spoke affectionately of him; and as a tribute to his memory all present stood for a moment with bowed heads.

It was the largest meeting of the association that has yet been held; 41 persons were present. The party began to gather at the Heimlich plant (Le Roy Lime and Crushed Stone Co.) about 10:30 a. m. and from that time until almost noon the members enjoyed themselves informally and inspected the quarry and plant. A new storage system with concrete silos has been added since the meeting last year and the "Ribstone" cement products plant, which was just beginning production at that time is now going strong. Mr. Heimlich said that they were selling all the plant could make.

A short stop was made at the plant of the General Crushed Stone Co., especially for the benefit of those who had not visited it before, and John Rice went around with a party and gave some explanation of the methods used. Then the drive was made to the hunting lodge, which is only a short distance beyond the General Crushed Stone Co.'s plant.

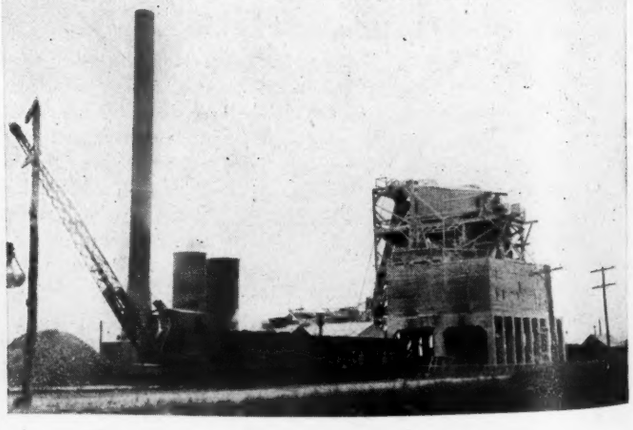
The lodge, a log cabin that has stood for over a century, was utilized as a kitchen and storehouse while the dinner was served on long tables spread under the big trees which make this clearing such a delightful spot. "Bill" Anderson, of the Hercules Powder Co., Buffalo, genial as ever, assisted materially as one of the hosts. The dinner menu was that of an old-fashioned clam bake with steamed clams, green corn and chicken served in individual baskets and eaten from paper plates in the classic manner. It was excellently cooked and served piping hot and everyone thoroughly enjoyed it.

New York State Crushed Stone Association at Le Roy, N. Y., October 1

Before dinner was served, John Rice made a short address on the life of F. W. Schmidt, recalling the fine work he had done for the crushed-stone industry in both the national and state associations; and the loss felt by the members on hearing of his death. After this speech all stood for a moment of silence. It was later voted that this should be placed in the minutes of the association and a copy of the minutes sent to Mrs. Schmidt.

After the dinner the

Cement products plant and silo of "Ribstone" tile



Crushing plant, Le Roy Lime and Stone Co.

Secretary Boyd tells of National Association affairs

members gathered on the benches that had been arranged before the house and the meeting was called to order by President A. G. Seitz, of Syracuse. George Schaefer, secretary, read the minutes of the previous meeting and commented on the article concerning it which had appeared in Rock Products of September 18. He then spoke of the work that was being done in connection with standardization of crushed-stone sizes and introduced J. R. Boyd, secretary of the National Crushed Stone Association. Mr. Boyd discussed the necessity of standardization and the work which the American Society for Testing Materials was doing to bring it about. He also spoke of the necessity for co-operation of the various societies and organizations interested in order that the system of standardization adopted might adapt itself to conditions in the principal producing sections.

Standardization, he said, was something which was dictated by economy and the members should consider it carefully and make specific recommendations to Mr. Goldbeck, the head of the research bureau of the National Crushed Stone Association. A good deal of "cut and try" might be necessary before final recommendations could be made, but it was hoped that the matter of standardization would be settled before the end of another year.

Mr. Boyd spoke also of some of the services which the National Association was ready to perform for its members, especially in connection with car shortages and the income tax returns.

Short talks were made by Division Engineers Smith, Dempster and Dowd of the New York State Highway Department, and a vote of thanks was given to Mr. Heimlich for his hospitality.

Those who were present:

A. G. Seitz (Rock-Cut Stone Co., Syracuse), president.

George Schaefer (General Crushed Stone Co.), secretary.

J. R. Boyd, secretary, National Crushed Stone Association.

John Rice, A. L. Scott, Lynn Croll, Grover Murphy, and James MacCone, General Crushed Stone Co.

John Odenbach, C. P. Odenbach, M. P. Odenbach and Frank Waddell, Dolomite Products Co., Rochester.

Albert Owens, Peerless Quarries, Inc., Utica.

D. N. Boice, Genessee Stone Products Co., Batavia.

William McGrew, C. D. Thorne and E. Hughes, L. and N. Stone Co., Prospect.

B. R. Babcock, Callanan Stone Co., Albany.

W. E. Foote, Wickwire Steel Co., Gasport.

J. L. Heimlich, W. R. Heimlich, Frank Howe and A. W. Rogers, Le Roy Lime and Crushed Stone Co., Le Roy, N. Y.

A. E. Weiser, Buffalo Cement Co., Buffalo.

James Savage and A. L. Hooker, Buffalo Crushed Stone Co., Buffalo.

J. H. Kaiser, Solvay Process Co., Syracuse.

W. E. McNasser and F. C. Owens, Rock-Cut Stone Co., Syracuse.

Daniel Hastings, Interstate Amiesite Co.

W. H. Margraf, Marble Cliff Quarries Co., Columbus, Ohio.

O. C. Dempster, division engineer at Hornell; H. E. Smith, division engineer at Rochester, Walter Dowd, Herbert Michels, and L. F. Gaffeny, all of the New York State Highway Department.

William Anderson, Hercules Powder Co., Buffalo.

F. C. Diehold, Buffalo Cement Co.

Edmund Shaw, Rock Products, Chicago.

Batesville Stone Quarry Sold

THE Pfeiffer stone quarry, located five miles north of Batesville, Ark., was sold recently under foreclosure to John P. Cargill of Kansas City, under an order entered in chancery court June 2 in favor of the American National bank and others of St. Joseph, Mo. The sale was made by Special Commissioner Oscar T. Jones. The purchas price was $177,350 with court costs.—*Little Rock (Ark.) Gazette.*

Refractory Bricks from Phosphate Rock

SOME months ago the chemical division of the Bureau of Foreign and Domestic Commerce published a bulletin from the American consul at Tunis reporting the shipment of a rather large tonnage of phosphate rock to brick manufacturers in Holland, who were to use it as a raw material for production of fire brick suitable for steel furnace lining. The chief of the division wrote for further information concerning the process, and recently reply has been received from the trade commissioner at Brussels, Belgium. He writes that the Dutch brick producers were extremely reluctant to give any information concerning their operation. They entertained some resentment against this country because of a ruling under the tariff act which requires foreign brick manufacturers to stamp their product to indicate the country of origin. Through a third person the trade commissioner learned that the Dutch company employed a patented process in the production of what is called phosphorine brick. He suggests that if American producers of phosphate rock are interested in the subject, it will be well to communicate with the Dutch company, as the latter, it is understood, is willing to enter into license arrangements with foreign producers. In deference to the wishes of the department, the names are not disclosed, but if any members are interested the full details will be given upon request.—*American Fertilizer.*

New storage bins of Le Roy Lime and Stone Co.

William McGrew explains matters to the Ohio visitor

Texas Production of Fullers Earth Increases

ACCORDING to statistics obtained by the Bureau of Economic Geology of the University of Texas, fullers earth was produced in Texas during 1925 to the amount of 30,462 tons, valued at $310,145. This amount represents a slight increase over that of 1924 and is greater by 10,997 tons than the production of 1923.

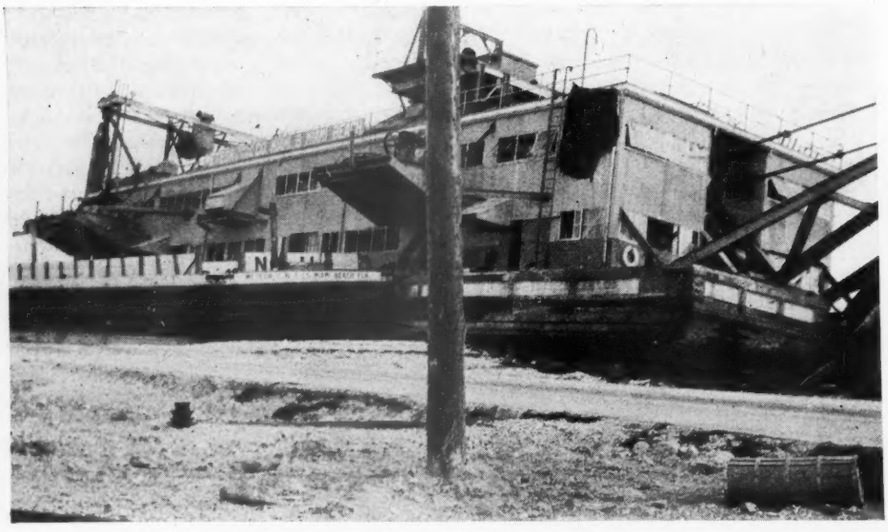
"For many years Florida has been the leader in the United States in the production of fullers earth," said Dr. E. H. Sellards, director of the bureau. "However, the increase in production in Texas in recent years indicates that in the near future this state may lead."

"Magic City" Survives Florida Hurricane

Meteor Transport and Trading Company's Famous Dredge Escapes Storm Without Very Serious Damage

THE dredge *Magic City* belonging to the Meteor Transport and Trading Co. of Miami Beach., Fla., passed through the hurricane which caused so much damage and loss of life without any fundamental injury. Repair parts have been ordered and in a comparatively short time the dredge will be in service again.

The *Magic City* is owned by one of the various enterprises in which Charles Warner of Wilmington, Del., is interested. His brother, Irving Warner, consulting engineer of the company, was largely responsible for the design of the dredge and the excellent construction that enabled it to withstand the most disastrous storm of recent years.



The dredge with a barge that stayed alongside

Irving Warner writes to Rock Products that the dredge, after the storm, was lying along the causeway between Miami and Miami Beach half in and half out of water. It had been driven to this point by the tremendous force of the wind that is authoritatively stated to have reached a velocity of 100 miles an hour. But in spite of the shocks to which it must have been subjected the hull suffered no fundamental damage.

The principal damage to the hull was superficial and was mainly that of broken glass in the doors and windows in the superstructure.

The greatest injury to the machinery was the buckling of the digging ladder around the edge of the well. The ladder dragged on the bottom as the dredge drifted into shoal water and this bent the ladder by pulling it around the edge of the well. The force required to do this must have been tremendous, as the ladder is made up of two plate and channel sections about four feet deep. This ladder was made by the Dravo company of Pittsburgh, Penn. It is practically the same as the ladder on the Keystone Dredge No. 8, which is described elsewhere in this issue.

The electrical machinery was drenched by the heavy rain so thoroughly and for so long a time that a great deal of it was ruined and will have to be replaced. Replacements and also a new center section for the dredging ladder were ordered at once.

There were 15 new barges which accompanied the dredge and these were widely scattered. Two went entirely over the causeway with the high waves and are now resting in the upper bay. Six landed on the causeway or on adjacent wharves. One was sent far inland, south of Miami, and the remainder were sunk. However, most of these barges will be recovered and will be put into service again.

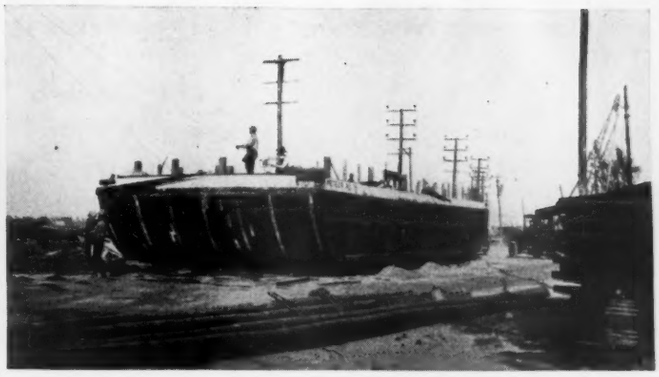
Mr. Warner writes that the company was well protected by insurance.

The *Magic City* was built at Wilington by the American Car and Foundry Co. and towed to Florida. Shortly before it was sent on its long trip to the south it was visited by a Rock Products editor in company with Irving Warner, who called attention to the hull construction. In building this hull Mr. Warner said he had followed somewhat the methods of bracing and of stiffening the structure with "hog irons" that was used in the construction of the old Mississippi steamboats. This design had proved itself by many years of use and it has proven itself again by passing through one of the severest storms that ever struck the gulf coast. The superstructure was so constructed as to brace both itself and the hull and hence the only damage to it was that of broken glass. The whole dredge seems to have been a proof of the value of good engineering. The only serious damage, that to the ladder, come from a side strain that it was not designed to resist and it could not be so designed without being too unwieldly. If the ladder had not buckled the strain on the hull, too, would have been far greater.

A description of the *Magic City* (during

Showing how the "Magic City" lay on the causeway after the storm

One of the barges driven ashore by the wind and jammed into a house on the beach



A barge which was driven on the beach in South Miami, several miles from the dredge

construction) was given in the issue of May 29 in an editorial letter. It is unique among dredges of its kind in that it was built to dig rock (coral limestone from the bottom of Miami bay) and not sand and gravel. It contained a regular crushing plant beside screens and sand recovery, and the sand recovery devices are the new Dorr sand wheels, of which this is among the first installations. The dredged rock is washed as well as screened and it is largely used as concrete aggregate and road construction.

The dredge is powered with a 500 hp. Worthington Diesel engine and has both rope and electric drives.

New Chemical Engineering Catalog

THE eleventh annual edition of the *Chemical Engineering Catalog* has just been received. This edition is divided into four sections: (1) The classified index of equipment and materials, compiled by the publishers; (2) equipment section, illustrating the newest types developed recently for the chemical and allied industries; (3) chemical and materials section, carefully cross-referenced and indexed, and (4) the technical books section in which is listed and described over 2000 books in English on chemical industries and related subjects.

The book contains 1176 pages and is bound in limp leather. The publishers are the Chemical Catalog Co., Inc., New York.

New Method for Measuring Strains in Concrete Structures

SOME time ago the Bureau of Standards, Department of Commerce, brought out what is known as an "electric telemeter" for measuring changes in the length of structural members produced by variations in the load upon the structure. The operation of the telemeter depends upon the variations in resistance to the passage of an electric current of a stack of carbon disks. This is the same principle as that employed in the microphone in the transmitter (the part we talk into) of the telephone. There is, therefore, nothing new in the principle employed, but the bureau was the first to apply this principle to a precision measuring instrument.

Recently a new use has been found for this device in the measurement of the strains in mass concrete. For this purpose a special cartridge has been designed which houses the stack of carbon disks and which is embedded in the concrete at the point where the measurement is to be made. Wire leads extend to the surface and are carried to some convenient point where the indicating instruments are placed. These instruments are calibrated to show any deformation in the concrete due to loading.

The instrument will shortly be used in an investigation which is to be carried out by a special committee sponsored by the Engineering Foundation on a dam to be erected at Fresno, Calif.

Close-up of the damaged section of the digging ladder which was bent around the well in the center of the hull

Colorado's Sand and Gravel Deposits

COLORADO'S large sand and gravel deposits have proved of great importance during the unusual building activities of the last few years, according to the Denver (Colo.) *Post*. The *Post* claims that this demand for all varieties of sand for building purposes would have taxed the resources of many localities outside the state, but that according to recently compiled statistics the supply in Colorado shows no sign of having been touched, so large are the state's deposits.

Varieties of sand available are the Platte river sand, reddish in color and used extensively in concrete and similar construction work; white Cherry creek sand which is best suited for white plaster and brick mortar work. Blow sand is that very fine formation which is used in asphalt construction, and is found in large quantities near Denver and in various parts of the state. Pure silica sand, which is used in making glassware and the finer grades of pottery, is another sand only to be found in northern Colorado and in certain mountain valleys. Great deposits of feldspar exist in the state.

C. W. Stevens Gravel Company Completes New Plant

THE C. W. Stevens Gravel Co. of Indianapolis, Ind., has completed its new plant at Troy avenue and Harding street, said to be one of the most modern plants in the Middle West. The new plant is located on a 40-acre tract owned by the company which extends down to White river. Although the company's holdings are bounded by the center line of the river, no river gravel is being used, all material being taken from a new pit some distance from the river.

The new equipment is all modern and includes a steel tower derrick and five modern steel storage bins, each having a capacity of approximately 100 cu. yd. of material. Steel construction was used throughout. The flume, storage tanks and screens all are built on concrete bases, in which has been installed a complete sewage system. Through pipes which collect all drainage from the plant, the wash water carrying a considerable quantity of fine sand and some gravel is carried back to the pits, reducing waste.

The washing system includes approximately 50 ft. of flume through which 600 gal. of water is forced each minute for cleaning the sand and gravel before screening. The plant is so equipped for transportation facilities that it can deliver 1000 yd. of product daily.

Sandy Pratt Buys Solano Plant

THE Vulcan Rock Co., which formerly operated a rock-crushing plant at Hoyt, Solano County, six miles from Benicia, has sold its interests to Clarence (Sandy) Pratt, president of the Pratt Building Material and the Pratt Rock and Gravel Co., who operate sand, rock and gravel plants at Sacramento, Marysville, Prattrock, near Folsom, and Prattco, Monterey county.

The Vulcan Rock Co. was started in March, 1907, by George U. Hind, George Rolph, M. M. O'Shaughnessy and Joseph A. Donohoe. They ceased to do business about ten years ago.

Mr. Pratt states that he expects to build a crushing plant of this property, with a spur track off of the Southern Pacific line and produce road material.

There are about thirty acres in the property and it is estimated to contain about 5,000,000 tons of good road rock.—*Sacramento (Calif.) Bee.*

Dr. Holmes at Missouri School of Mines

M. E. HOLMES has become the head of the department of economic engineering at the Missouri School of Mines, Rolla, Mo. This is in correction of the announcement appearing in some early press run copies of the September 18 issue of ROCK PRODUCTS which stated that he was to take charge of the ceramic engineering department at Ohio State University, Columbus.

Portland Cement Association Makes Important Appointments

THE Portland Cement Association announces that the following appointments in its general office staff were made, effective October 1: C. R. Ege, manager, Advertising and Publications Bureau, succeeding H. C. Campbell, resigned; G. S. Eaton, assistant manager, Advertising and Publications Bureau; W. E. Hart, manager, Highways and Municipal Bureau (formerly Highways Bureau); F. R. McMillan, manager, Structural and Technical Bureau (formerly Structural Bureau), and T. J. Harris, manager, General Educational Bureau.

C. R. Ege

Mr. Ege is an associate member of the American Society of Civil Engineers, has served as treasurer and is now president of the Highway Industries Association. He has been with the association for 10 years, and manager of the Highways Bureau since 1920.

W. E. Hart

Mr. Eaton has been with the association over six years, prior to which he was a member of the staff of the Associated General Contractors. He was at first on the staff of the Highways Bureau and has been prominently identified with the publicity and publications features of the association's work.

Mr. Hart is an associate member of the American Society of Civil Engineers and is prominent in the affairs of the American Concrete Institute. He has been with the association nine years and for four years has been manager of the structural bureau, after having served three years as district engineer at Minneapolis.

Mr. McMillan is a member of the American Society of Civil Engineers and has been associate engineer with the research laboratory of the association for two years, prior to which he was engaged in consulting engineer at Minneapolis. His contributions to engineering literature are widely known, particularly through the American Society of Civil Engineers and the American Concrete Institute.

Mr. Harris has been prominently identified with the advertising activities of the association for six years. He has had newspaper experience of note and is identified with numerous organizations in the journalistic field.

Coal Dust Explosion at Speed, Indiana, Cement Mill

TWO men employed in the plant of the Louisville Cement Co., at Speed, Ind., near Louisville, Ky., suffered severe burns, about the face, head and body, from which they are expected to recover, as a result of an explosion of coal dust. While clearing two coal-dust feed pipes which had become clogged, dust from the pulverized material accumulated in the room, and exploded without warning, burning the men and setting their clothing on fire. The men stumbled from the room, stripped off their burning clothing, and after treatment in the emergency hospital of the plant were rushed to a hospital at Jeffersonville, Ind. The explosion was of the flare type and caused no plant damage, the report states.

Gorsuch Bros. Sell Slate Plant

GORSUCH BROTHERS, INC., have sold 11 acres of land near Peach Bottom, Penn., including their plant and slate deposits, to the Philadelphia Electric Co. for $150,000. The company retains 22 acres of their holdings there. The purchasers are the owners of the Conowingo dam project now in course of construction. Possession will be given at once. The railroad tracks at that point will be raised nearly 20 ft. above the present level.—*Wilmington (Del.) Star.*

Sand-Lime Brick Production and Shipments in September

ACCORDING to statistics received direct from 16 sand-lime brick manufacturers located in the United States and Canada, production and shipments of sand-lime brick were below that of the previous month. Stocks on hand are more than at the end of August and the total of unfilled orders show a considerable decrease. These statistics are not quite complete for one of the plants reporting gave out no statistics on the production, and two failed to report stocks on hand and unfilled orders. The plants furnishing data constitute over one-third of the number in operation in the United States and Canada and are about the largest producers, their total output being about one-half the production in the two countries.

The following are average prices for sand-lime brick in September:

	Plant Price	Delivered
Saginaw, Mich.	$12.00	.....
Madison, Wis.	12.50	$14.00
Milwaukee, Wis.	10.50	13.00
Jackson, Mich.	12.50	.....
Lakeland, Fla.	10.00	14.00@16.00
Woburn, Mass.	13.90	.....
Detroit, Mich.	14.35	17.00
Detroit, Mich.	15.00	16.20
Flint, Mich.	12.00	.....
Menominee, Mich.	11.00@12.00	14.50
Hartford, Conn.	15.00	20.00
Michigan City, Ind.	11.00	.....
Dayton, Ohio	12.50	.....
Grand Rapids, Mich.	12.00	.....
Toronto, Ont.	13.10	15.60
Minneapolis, Minn.	10.00	12.75@16.50

The following table gives comparative statistics for August and September:

	August*	September
Production	17,435,000	15,126,000
Shipments (rail)	7,690,000	6,663,000
Shipments (truck)	9,870,000	8,694,000
Stocks	†8,770,000	‡9,877,000
Unfilled orders	†24,200,000	‡18,651,000

*Revised to include statistics for two plants not reporting in August.
†Incomplete (two plants not furnishing data on stocks and unfilled orders).
‡Incomplete (two plants not furnishing data on stocks and unfilled orders).

Not much new business is reported and the slacking off of production may be attributed to the general inclement weather throughout sections of the country where the different plants are located. This has held back many buildings now in the course of construction and because of the rains and approaching cold weather the outlook for increased production is very doubtful. The Flint Sandstone Brick Co. reports that it has obtained the contract to furnish about 2,000,000 for the new General Motors Co. foundry which is to be built.

Winchester Brick Company Plant Damaged Through Fire

An early morning fire caused heavy damage to the plant and some of the equipment of the Winchester Brick Co., Woburn, Mass., on October 2. The loss is estimated at about $50,000.

The fire is believed to have started in the kiln room, an accumulation of waste having caught in some way. It spread rapidly throughout the entire plant and destroyed all the wooden uprights and joists holding the sheet metal roof in place. A long passageway between the kiln room and the press room supplied the draught to carry the blaze into the press room where it fastened onto all the wood uprights supporting shafting and roof from which many pulleys and chain falls were suspended.

The layout of the company consists of four inter-connected buildings and the interior of these were all badly damaged. It is believed that the kilns and presses, being of iron, escaped serious injury. Although the boiler room was gutted by flames, the boilers, it is believed were not harmed. Lack of water and distance from fire plugs seriously handicapped the firemen.

General Superintendent Frank T. Gallagher and Assistant Superintendent Neal Austen were on hand early after the fire, supervising the removal of debris. According to officials, reconstruction will begin at once and pending the completion of the new buildings, some sort of a temporary arrangement will be made so that the large contracts for brick can be filled within specified time. The company has been supplying material for over 20 large buildings now under construction.—*Woburn (Mass.) Daily Times.*

Technology of Sand Lime Brick

THE technical progress made by the Bureau of Standards in the manufacture and testing of sand lime brick has been compiled and published in a handy little book which all interested in the product should have on hand as a reference and study. ROCK PRODUCTS has published the greater part of these either in abstract or in full but for convenience, a list of the bulletin's contents follows:

"Results of Testing Sand-Lime Brick" by Warren E. Emley; "Analytical Study of Brick Specifications" by Warren E. Emley; "Calcium Silicate" by W. E. Emley, A. A. Klein, E. M. Sanborn; "Report of Work Done During 1915" by Warren E. Emley; "Effects of Various Factors on the Properties of Sand-Lime Brick" by Warren E. Emley and Samuel Freed; "Effects of Various Factors on the Properties of Sand-Lime Brick" by F. A. Kirkpatrick and F. W. Lapham; "Evidence of Durability of Sand-Lime Brick" by F. A. Kirkpatrick and J. S. Palmer; "The effect of Size of Sand Upon Strength and Absorption of Sand-Lime Brick" by F. A. Kirkpatrick and F. W. Lapham; "Effect of Duration of Hardening on the Properties of Sand-Lime Brick;" "Evidence of The Enduring Qualities of Sand-Lime Brick"; "How Brick Piers Fail"; The Effect of Grading of Sand Upon Absorption and Transverse Strength of Sand-Lime Brick" by W. E. Emley and H. V. Johnson; "The Effect of Grading of Sand Upon the Properties of Sand-Lime Brick" by H. V. Johnson; "Effect of Pressure and Steaming on the Compressive Strength of Cement-Lime Mortars" by H. V. Johnson; "Results of Compressive Tests on Sand-Lime Brick Walls" by H. L. Whittemore and A. H. Stang; "Some Physical Properties of Sand-Lime Brick" by H. V. Johnson; "Lime Mortar Bricks vs. Sand-Lime Bricks" by H. V. Johnson.

This volume has been prepared to place before engineers, architects, contractors and others the valuable results of considerable research work accomplished.

National Conference on Building Costs

CONVINCED that the public and private construction costs are now unnecessarily high, building experts from all parts of the country met at Kansas City, October 4-7, in an effort to remedy existing conditions.

The conference, which was held under the auspices of the Associated General Contractors of America, gave special attention to the record-breaking construction activities of recent weeks.

The following elements, among others, were cited as causing construction costs to mount unnecessarily and were discussed with intensive consideration by the conference; incomplete or muddled contracts; misuse of lien laws; promiscuous issuance of surety bonds; construction of public works under the "day labor" system; seasonal operations, and wasteful financing methods.

Virtually every large construction center in the country was visited by the builders en route to Kansas City, and current conditions in all sections were thus subjected to close scrutiny, it is stated.

The conference followed one held several months ago at Washington, when general plans of procedure for "cleaning house" within the construction industry were laid. It was for the purpose of designing means for thorough application of the proposed reforms that the Kansas City meeting was held.

"Mainly the effort will be to rid the construction industry of irresponsible and incapable bidders, whose activities result in direct losses through defaults and also produce indirect losses through the upsetting of the industry's stability," the official announcement states.

"Means by which the building public can act to be assured of securing the greatest possible return for each dollar expended for construction will be given definite outlines," the statement continues.

"There can be no doubt that construction prices now are feeling the result of absence or organized supervision of the construction industry during many decades. Through use of standard contracts, close accounting of operations carried on directly by public officials without use of the contract system, and precise rating of contractors according to skill, integrity and responsibility, many existing handicaps to economical construction will be removed."

Output of Portland Cement in 1925

Final Revised Statistics Including Estimated Per Capita Consumption

FINAL figures relating to the portland cement industry in 1925, compiled by the Bureau of Mines, Department of Commerce, show that the production of portland cement in 1925—161,658,901 bbl.—was the largest quantity manufactured thus far in any year, exceeding that in 1924, the next highest year in production by about 8%.

Shipments of portland cement from mills in 1925 increased 8% in quantity and over 5% in gross value. The average factory price per barrel in bulk in 1925 was $1.77, a decrease of 4c per barrel as compared with the average price received in 1924.

Stocks at the mill also increased, reaching a total of 18,515,384 bbl. on December 31, 1925, the greatest at the end of any year during which official records of stocks have been kept. They were about 31% higher than at the end of 1924.

From reports of the producers showing

PORTLAND CEMENT PRODUCED, SHIPPED AND IN STOCK IN THE UNITED STATES, 1924 AND 1925, BY DISTRICTS

Commercial district	Active plants 1924	Active plants 1925	Production—Barrels 1924	Production—Barrels 1925	Production Inc. or dec. 1925 (pct.)	Shipments 1924 Barrels	Shipments 1924 Value	Shipments 1925 Barrels	Shipments 1925 Value	Avg. factory value per barrel 1924	Avg. factory value per barrel 1925	Inc. or dec. in quantity 1925 (pct.)	Stock—Barrels 1924	Stock—Barrels 1925	Stock Inc. or dec. 1925 (pct.)
E'n Penn., N. J. & Md.	22	22	38,656,739	40,279,457	+ 4	37,989,250	$65,500,657	40,286,898	$70,094,072	$1.72	$1.74	+ 6	2,541,627	2,534,186	— .3
New York	9	9	7,571,856	8,769,584	+16	7,435,875	13,460,594	8,534,089	14,967,642	1.81	1.75	+15	792,831	1,028,326	+30
Ohio, W'n Penn. & W. Va.	12	14	14,331,451	15,572,602	+ 9	14,028,762	25,104,849	14,628,575	25,614,083	1.79	1.75	+ 4	1,369,916	2,313,943	+69
Michigan	15	16	9,259,781	10,936,181	+18	8,991,270	16,405,761	10,073,453	17,511,908	1.82	1.74	+12	1,060,047	1,922,775	+81
Wis.,* Ill., Ind. & Ky.	11	11	21,823,469	23,521,488	+ 8	21,343,396	37,189,604	22,052,884	37,792,110	1.74	1.71	+ 3	2,041,760	3,510,364	+72
Va., Tenn., Ala. & Ga.	12	14	11,411,054	13,505,792	+18	11,374,280	19,201,389	13,048,251	21,581,494	1.69	1.65	+15	491,474	949,015	+48
E'n Mo., Ia., Minn. & S. Dak.†	11	11	14,822,738	14,571,751	— 2	13,984,167	24,757,538	14,477,932	25,317,292	1.77	1.75	+ 4	2,737,240	2,831,059	+ 3
W'n Mo., Neb., Kans. & Okla.	11	11	9,892,813	10,672,816	+ 8	9,586,984	16,262,422	10,524,247	17,772,268	1.70	1.69	+10	1,507,824	1,656,393	+10
Texas	5	6	4,565,983	4,858,212	+ 6	4,488,143	8,322,658	4,735,521	8,729,046	1.85	1.84	+ 6	356,212	478,903	+34
California	5	5	2,423,830	2,005,071	—17	2,377,774	5,081,599	2,018,034	4,388,453	2.14	2.17	—15	315,990	303,027	— 4
Colo. & Utah	10	10	11,615,379	13,098,140	+13	11,481,730	25,532,707	13,109,426	26,159,531	2.22	2.00	+14	502,584	491,298	— 2
Ore., Wash. & Mont.	9	9	2,983,016	3,867,807	+30	2,965,918	7,226,930	3,805,902	8,596,209	2.44	2.26	+28	434,190	496,095	+14
	132	138	149,358,109	161,658,901	+ 8	146,047,549	$264,046,708	157,295,212	$278,524,108	$1.81	$1.77	+ 8	14,151,695	18,515,384	+31

*Wisconsin began producing and shipping June, 1924. †South Dakota began producing December, 1924, and shipping January, 1925.

PORTLAND CEMENT PRODUCED, SHIPPED AND IN STOCK IN THE UNITED STATES, 1924 AND 1925, BY STATES

State	Active plants 1924	Active plants 1925	Production—Barrels 1924	Production—Barrels 1925	Production Inc. or dec. 1925 (pct.)	Shipments 1924 Barrels	Shipments 1924 Value	Shipments 1925 Barrels	Shipments 1925 Value	Avg. factory value per barrel 1924	Avg. factory value per barrel 1925	Inc. or dec. in quantity 1925 (pct.)	Stock—Barrels 1924*	Stock—Barrels 1925	Stock Inc. or dec. 1925 (pct.)
Alabama	5	5	5,552,550	6,288,117	+13	5,542,687	$9,147,367	6,045,967	$9,824,439	$1.65	$1.62	+ 9	146,229	388,379	+166
California	10	10	11,615,379	13,098,140	+13	11,481,730	25,532,707	13,109,426	26,159,531	2.22	2.00	+14	502,584	491,298	— 2
Illinois	4	4	6,994,323	7,101,024	+ 2	6,955,455	12,026,310	6,749,532	11,481,576	1.73	1.70	— 3	691,334	1,042,826	+51
Iowa	5	5	5,624,466	4,648,145	—17	4,881,613	8,811,587	4,856,849	8,674,563	1.81	1.79	— 1	1,695,193	1,486,489	—12
Kansas	7	7	5,894,236	6,511,393	+10	5,809,646	9,900,547	6,513,297	10,861,506	1.70	1.67	+12	892,413	890,509	— .2
Michigan	15	16	9,259,781	10,936,181	+18	8,991,270	16,405,761	10,073,453	17,511,908	1.82	1.74	+12	1,060,047	1,922,775	+81
Missouri	5	5	7,871,621	8,331,751	+ 6	7,711,206	13,515,267	8,168,165	14,155,795	1.75	1.73	+ 6	921,165	1,084,751	+18
New York	9	9	7,571,856	8,769,584	+16	7,435,875	13,460,594	8,534,089	14,967,642	1.81	1.75	+15	792,831	1,028,326	+30
Ohio	7	9	4,600,835	5,714,685	+24	4,298,027	7,836,325	5,426,768	9,600,084	1.82	1.77	+26	656,590	944,507	+44
Pennsylvania	22	22	40,849,602	42,346,830	+ 4	40,208,860	69,693,517	41,899,787	72,870,981	1.73	1.74	+ 4	2,759,021	3,206,064	+16
Texas	5	6	4,565,983	4,858,212	+ 6	4,488,143	8,322,658	4,735,521	8,729,046	1.85	1.84	+ 6	356,212	478,903	+34
Washington	4	4	1,842,113	2,481,923	+35	1,793,403	4,236,554	2,499,237	5,523,324	2.36	2.21	+39	289,614	272,300	+ 6
Other states†	34	36	37,115,364	40,572,916	+ 9	36,449,634	65,157,514	38,683,121	68,163,713	1.79	1.76	+ 6	3,388,462	5,278,257	+56
	132	138	149,358,109	161,658,901	+ 8	146,047,549	$264,046,708	157,295,212	$278,524,100	$1.81	$1.77	+ 8	14,151,695	18,515,384	+31

*Revised. †Includes Colorado, Georgia, Indiana, Kentucky, Maryland, Minnesota, Montana, Nebraska, New Jersey, Oklahoma, Oregon, South Dakota, Tennessee, Utah, Virginia, West Virginia and Wisconsin.

SHIPMENTS OF DOMESTIC PORTLAND CEMENT FROM MILLS INTO STATES AND PER CAPITA, 1924 AND 1925, IN BARRELS*

State	1924 Total	1924 Per capita*	1925 Total	1925 Per capita*
Alabama	1,872,997	0.76	2,084,922	0.85
Arizona†	415,146	1.04	423,523	1.04
Arkansas†	1,084,020	.59	800,407	.43
California	10,846,703	2.73	12,433,619	3.09
Colorado	1,337,466	1.32	1,152,498	1.13
Connecticut†	1,582,312	1.04	1,758,443	1.15
Delaware†	385,581	1.65	401,923	1.71
District of Columbia†	722,960	1.47	886,236	1.78
Florida†	2,177,233	2.02	4,150,091	3.28
Georgia	1,408,106	.46	1,438,009	.47
Idaho†	262,422	.54	258,553	.53
Illinois	13,328,219	1.93	14,404,947	2.07
Indiana	5,522,818	1.81	4,997,971	1.63
Iowa	3,144,001	1.26	2,704,872	1.08
Kansas	2,142,725	1.18	2,257,447	1.25
Kentucky	1,763,538	.71	1,796,397	.72
Louisiana†	1,260,231	.67	1,100,099	.59
Maine†	386,593	.49	333,829	.43
Maryland	1,989,182	1.30	2,127,479	1.38
Massachusetts†	3,359,553	.82	3,418,028	.83
Michigan	9,355,024	2.28	9,564,976	2.31
Minnesota	3,248,369	1.28	3,615,328	1.41
Mississippi†	527,046	.29	579,239	.32
Missouri	3,985,049	1.15	5,600,510	1.62
Montana	202,782	.32	235,525	.36
Nebraska	1,499,998	1.11	1,674,944	1.24
Nevada†	91,821	1.19	100,997	1.30
New Hampshire†	378,554	.84	426,138	.95
New Jersey	6,410,037	1.84	7,082,207	2.02
New Mexico†	231,970	.61	181,927	.48
New York	17,456,377	1.58	18,488,762	1.66
North Carolina†	2,999,559	1.09	3,024,621	1.10
North Dakota†	248,732	.36	341,841	.50
Ohio	9,262,652	1.48	9,221,005	1.46
Oklahoma	2,210,586	1.00	2,377,673	1.06
Oregon	1,211,462	1.44	1,318,163	1.56
Pennsylvania	12,964,163	1.40	14,932,787	1.60
Rhode Island†	608,355	.96	711,391	1.05
South Carolina†	570,631	.32	864,166	.49
South Dakota‡	466,725	.70	461,726	.68
Tennessee	1,558,825	.65	1,644,029	.68
Texas	3,853,698	.76	4,188,910	.82
Utah	427,825	.88	381,018	.77
Vermont†	300,102	.85	217,286	.62
Virginia	1,701,408	.70	1,648,744	.67
Washington	1,730,483	1.18	2,427,263	1.64
West Virginia	1,661,042	1.05	1,487,663	.93
Wisconsin	4,515,256	1.62	4,105,100	1.47
Wyoming†	331,309	1.51	225,170	1.01
Unspecified	59,899	.....	59,272	.....
	145,061,545	1.29	156,117,674	1.38
Exports reported by manufacturers but not included above§	986,004	.....	1,177,538	.....
Total shipped from cement plants	146,047,549	.....	157,295,212	.....

*Per capita figures based on estimate of population made by the Bureau of the Census.
†Non-cement-producing state.
‡South Dakota began shipping January, 1925.
§Includes shipments to Alaska, Hawaii and Porto Rico.

mill shipments of portland cement into the various states estimates of per capita consumption in the accompanying table have been compiled. These are at best but approximations as they represent only the records of mill shipments into states; they do not include the imports, which would increase the consumption in states nearest the seaports and in certain states near the Canadian border, nor do they make allowance for a variable but considerable stock of cement at all times in transit, in warehouses at distributing points, and awaiting use at jobs.

The total manufacturing capacity of all the active plants at the end of 1925 was 193,391,000 bbl., according to manufacturers' reports supplemented by a few estimates. This total, which is subject to revision, includes the annual capacity—about 5,800,000 bbl. of finished portland cement—of six new plants that began operating during the year. They are located as follows: One each in Georgia, Michigan, Texas, and Virginia, and two in Ohio.

A summary of the monthly estimates of output of portland cement in 1925, compiled from the monthly reports of producers, was published early in January, 1926, by the Bureau of Mines. These estimates, which indicated a production of 161,202,000 bbl. and shipments of about 156,724,000 bbl., were within 0.3 and 0.4%, respectively, of the final figures for 1925. The statistics here presented are based on revised annual returns from every active plant in the country.

PORTLAND CEMENT MANUFACTURING CAPACITY OF THE UNITED STATES, BY COMMERCIAL DISTRICTS, 1924 AND 1925

District	Estimated capacity (barrels) 1924	1925*	Percentage of capacity utilized 1924	1925*
Eastern Pennsylvania, New Jersey and Maryland	43,831,000	43,607,000	88.2	92.4
New York	9,107,000	10,199,000	83.1	86.0
Ohio, Western Pennsylvania and West Virginia	16,289,000	18,994,000	88.0	82.0
Michigan	11,501,000	15,301,000	80.5	71.5
Wisconsin, Illinois, Indiana and Kentucky	23,532,000	26,091,000	92.7	90.2
Virginia, Tennessee, Alabama and Georgia	12,889,000	15,746,000	88.5	85.8
Eastern Missouri, Iowa, Minnesota and South Dakota	17,675,000	18,942,000	83.9	76.9
Western Missouri, Nebraska, Kansas and Oklahoma	12,202,000	13,240,000	81.1	80.6
Texas	5,175,000	5,830,000	88.2	83.3
Colorado and Utah	3,205,000	3,275,000	75.6	61.2
California	14,727,000	16,474,000	78.9	79.5
Oregon, Washington and Montana	4,967,000	5,692,000	60.1	68.0
	175,100,000	193,391,000	85.3	83.6

*Subject to revision.

International Road Congress Will Meet in United States in 1929

THE International Road Congress will accept an invitation to meet in the United States in 1929, according to Senator Albert Mathieu, of France, president of the association. This assurance was given at the close of the congress held at Milan, Italy, September 6 to 14, and in response to the statement by Thomas H. MacDonald, chief of the United States Bureau of Public Roads and chairman of the official delegation from the United States, that the United States Congress would be urged to extend such an invitation.

The congress at Milan was attended by 2,000 delegates from 50 countries and five continents, and the United States was officially represented for the first time. Mr. MacDonald was made a member of the council of the congress.

In the discussions of the congress the United States and Great Britain declined to adhere to a resolution commending as a general policy the private operation of government subsidized toll roads, which has been tried out successfully on some stretches of Italian road. The United States delegates advanced the argument that roads are a government function and should be open to the use of all except in rare cases where private construction should eventually result in public operation. A resolution providing for all viewpoints was adopted.

Following the meeting in Milan the United States delegates went to Rome, where they were received in a private audience by Premier Mussolini, who asked them to convey a mesage to the United States that they had seen a disciplined and tenacious people courageously at work and desiring only peace. In response to Mr. MacDonald's statement that in modern highway transportation there is a new way of living ahead for the masses, the premier stated his conviction that motor roads must be built everywhere as railroads and carriage roads have been built in the past.

The American delegation left Rome for a survey of traffic and road conditions in western Europe and sailed from Southampton on October 12.—*Public Roads.*

H. Colin Campbell Resigns from Portland Cement Association

AS noted elsewhere in this issue, a number of changes in the officers of the Portland Cement Association have been made. That which will interest the engineering public more than any other is the resignation of H. Colin Campbell. Mr. Campbell was compelled to take this step on account of his ill health and he will take a long vacation in which to recuperate.

The outstanding feature of engineering progress in the last quarter century has been the development of concrete as a construction material. Many men have played their part in this, scientists, engineers, architects and contractors, but Mr. Campbell's part was probably as great as anyone's. He collected the records of what has been done, and the possibilities of concrete as visioned by laboratory workers and engineers, and brought them to the attention of the public. Under his direction the publicity work of the Portland Cement Association was almost unique in that it was among the first to "sell" the use of a material to the public rather than to sell the material itself. The proper and economical use of cement was always stressed in this work. Some of the handbook on the use of concrete, such as "Concrete on the Farm," were written by Mr. Campbell himself.

Mr. Campbell has not announced what he will do when he has recovered his health. In leaving he bears with him the best wishes not only of his associates but all those who know of his work in the development of the concrete industry.

H. Colin Campbell

Delayed Blast Kills Three

THREE workmen were killed in a delayed explosion of dynamite in the limestone quarry of the Atlas Portland Cement Co. at Leeds, Ala. The men were removing part of a charge which failed to go off in a previous shot. A coroner's investigation failed to assign cause for the fatal blast.—*Atlanta (Ga.) Constitution.*

Gas Explosion at Cement Plant

THREE men are in the hospital as a result of a gas explosion at the Fredonia, Kas., plant of the Consolidated Cement Corp. The explosion was caused, according to an eye witness, when a gas line parted and ignited from the flames of the kilns. Before the gas could be shut off, the large flames enveloped three workers and burned them severely.—*Fredonia (Kas.) Herald.*

Traffic and Transportation

EDWIN BROOKER, Consulting Transportation and Traffic Expert
Munsey Building, Washington, D. C.

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning October 11:

CENTRAL FREIGHT ASSOCIATION DOCKET

14184. **Crushed stone** and articles taking same rates, carloads, Spore, O., to Cincinnati, O. (C., C., C. & St. L. R. R. delivery.) Present rate 135c per net ton; proposed, 100c per net ton.

14186. **Sand and gravel,** other than blast, core, engine, filter, fire or furnace, glass, grinding or polishing, loam, moulding or silica, carload, from siding of the Buck Hill Washed Sand and Gravel Company, west of Canton, O., to Canton, O. Present rate, 60c per ton of 2000 lb.; proposed, 50c per ton of 2000 lb.

14187. **Crushed stone,** carload, Martin, O., to Carrollton, Oneida and Sherrodsville, O. Present rate, 6th class; proposed, 120c per net ton.

14188. **Crushed stone** and articles taking same rates, carload, Spore, O., to following points in West Virginia: North Pinch, Elkview, Colbon, West Blue Creek, Blue Creek, South Penn Siding, Oil Siding, Three Mile, Victor, Shrader, Coco, Pentacre, Quick, Coalridge, Sanderson, Acup, Rock Camp, Middle Fork, Kendalia, Pond Fork, Best, Wills Hollow, Blakeley, Hitop.

Present rate, 6th class; proposed, 160c per net ton.

14189. **Gravel and sand,** other than blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, moulding or silica, carload, Ambridge, Baden, Freedom and Rochester, Pa., to Scenery Hill, Pa. Present rate, 140c per ton of 2000 lb., from all points except Rochester, Pa., per Rochester, Pa., per C. F. A.-T. B. Tariff I. P. R. R., I. C. C., F1613, and 15 cents from C. C. 1634; proposed, 125c per ton of 2000 lb.

14190. **Gravel and sand,** carload, East Liverpool, O., to Columbiana, East Palestine, Niles, Girard, Warren and Youngstown, O. Present rates, 90c per ton of 2000 lb.; proposed, 80c per ton of 2000 lb.

14191. **Sand,** blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, moulding or silica, carload, Rynd Farm, Pa., to Oil City, Pa. Present rate, 135c per ton of 2000 lb.; proposed, 90c per ton of 2000 lb.

14192. **Sand,** blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, moulding or silica, carload, Rynd Farm, Pa., to New Castle, Pa. Present rate, 14½c; proposed, 126c per ton of 2000 lb.

14157. **Sand and gravel,** carloads, East Liverpool, O., to Newcomerstown, O. Present rate, 100c per net ton; proposed, 100c per net ton.

14231. **Crushed stone and screenings,** carloads, Shaw Junction, Hillsville and Walford, Penn., to Rocky River, Dover, Bay Park and North Dover, O. Present rate, 6th class; proposed, 100c per 2000 lb.

14232J. **Crushed stone and screenings,** carloads, Hillsville and Shaw Junction, Penn., to Lincoln Mine, Penn. Route—Via P. & L. E. R. R. and P. R. R. Present rate, 6th class; proposed, 160c per 2000 lb.

14237. **Agricultural limestone,** in open top cars, carloads, Middlepoint, O., to various points in Ohio.

To Ohio pts.—	Prop.*	To Ind. pts.—	Prop.*
Cleveland	$1.25	Kokomo	$1.15
Niles	1.40	Ridgeville	1.05
Newcomerstown	1.30	Logansport	1.05
Ravenna	1.25	Frankfort	1.20
Xenia	1.10	Indianapolis	1.25
Cincinnati	1.10	Columbus	1.40
Columbus	1.10	Terre Haute	1.40
Bradford	1.00	South Bend	1.10
Mt. Vernon	1.20	Richmond	1.10

*Per net ton. Present rates, 6th class.

14242. **Crushed gravel,** carloads, East St. Louis, Ill., to Hamilton, Ont. Present rate, 34c; proposed, 25½c.

14243. **Crushed stone** and articles taking same rates, carloads, Bellevue, O., to East Sparta, O. Present rate, 80c per net ton; proposed, 110c per net ton.

14244. **Crushed stone,** gravel and sand, except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, carloads, Kenneth and Lake Ciecott, Ind., to Collinsville, O. Present rate, 145c per net ton; proposed, 127c per net ton.

14247. **Sand and gravel** in open top cars, carloads, Dresden, O., to East Fultonham, O. Present rate, no through class or commodity rates in effect; proposed, 65c per net ton.

SOUTHWESTERN FREIGHT BUREAU DOCKET

9826. **Sand,** from Guion, Ark., to Three Rivers, Tex. To establish a rate of 21c per 100 lb. on sand, carloads, minimum weight 80,000 lb., or if marked capacity of car is less than 80,000 lb., marked capacity will govern, from Guion, Ark., to Three Rivers, Tex. There was recently established a rate of 23c per 100 lb. on this traffic, this rate being the same as in effect to Laredo, Texas, on traffic destined to points in Mexico. The rate of 23c has been given a trial and shippers are unable to place any sand at Three Rivers, Texas, in competition with sand produced at other points.

9835. **Sand,** from points in Arkansas to Okmulgee, Okla. To establish a rate of 12c per 100 lb. on sand carloads, minimum weight 80,000 lb., or if marked capacity of car is less than 80,000 lb., marked capacity will govern, from Guion and Ruddells, Ark., to Okmulgee, Okla.

The present rate is of such volume that shippers cannot maintain movement in competition with other shipping points more distant, and in view of location feel are entitled to basis that will permit movement.

9849. **Agricultural limestone,** from points in Missouri to points in Kansas. To establish the following rates on agricultural limestone (to apply only on crushed limestone, agricultural, which has been passed or will pass through a screen with round holes one-eighth of an inch or less in diameter), carload. Minimum weight: 90 per cent of marked capacity of car except when weight of shipment loaded to full visible capacity of car is less than 90 per cent of marked capacity of car, actual weight will apply, but in no case shall the minimum weight be less than 40,000 lb., from Galloway, Ash Grove and Phenix, Mo., to points on the St. L.-S. F. Ry. in Kansas within a radius of 260 miles. Rates in cents per ton of 2000 lb.:

Distance	Rates
50 miles and under	60
60 miles and over 50	65
70 miles and over 60	70
80 miles and over 70	75
90 miles and over 80	85
100 miles and over 90	90
110 miles and over 100	95
120 miles and over 110	100
140 miles and over 120	110
150 miles and over 140	115
170 miles and over 150	120
180 miles and over 170	125
190 miles and over 180	130
200 miles and over 190	135
220 miles and over 200	140
240 miles and over 220	150
260 miles and over 240	155

Rates in cents per 100 lb., except as noted.

	From—		
To	Ash Grove, Mo. (1) Rate	Galloway, Mo. (1) Rate	Phenix, Mo. (1) Rate
(Kansas)			
Columbus	95	100	100
Sherwin	100	110	100
Oswego	110	110	110
Mound Valley	115	115	115
Cherryvale	115	120	115
Neodesha	120	125	120
Fredonia	120	130	125
Severy	135	140	135
Galena	100	100	100
Rosedale	125	135	120
Lenexa	120	130	120
Olathe	120	130	115
Paola	115	120	115
Pleasanton	95	110	100
Ft. Scott	85	100	90
Godfrey	85	100	85
Girard	90	110	95
Cherokee	90	110	95
Parsons	110	120	110
Pittsburg	85	100	90

(1) Rates in cents per ton of 2000 lb.

A scale of rates approved by the Western Trunk Line Committee was published from Carthage, Mo., to St. L.-S. F. Ry. destinations in Kansas. Shippers at Phenix, Galloway and Ash Grove who are in direct competition with Carthage to the territory involved are asking that they be given the same basis in order to successfully meet the competition.

9848. **Sand and gravel,** from Willaco, Ark., to points in Oklahoma. To establish the following rates in cents per 100 lb. on sand and gravel, carload, minimum weight, 80,000 lb., or if marked capacity of car is less than 80,000 lb., marked capacity will govern, from Willaco, Ark., to points in Oklahoma shown:

To	Rates	To	Rates
Valliant	7	Jasper	7
Swink	7	Unger	7
Ft. Towson	7	Boswell	7
Sawyer	7	Bennington	8
Fallon	7	Bokchito	8
Economy	7	Blue	8
Hugo	7	Pirtle	8½
Forney	7	Durant	8½
Soper	7		

Shippers at Willaco, Ark., have been unable to reach Oklahoma points beyond the 9702 territory because of class rates being applicable. It is thought that the extension of the 9702 scale will enable them to compete more successfully with Oklahoma competitors.

9903. **Lime,** from Ashgrove, Mo., to points in Minnesota. To establish the following rates in cents per 100 lb. on lime, carloads, minimum weight 30,000 lb., from Ashgrove and other Missouri points shown in Group 1, as per St. L.-S. F. Ry. Trf. 69K to points shown below:

To C. & N. W. Ry. (Minnesota)	Rates	To C. & N. W. Ry. (Minnesota)	Rates
Butterfield	26	Milroy	26
Durfur	26	Dudley	26
Comfrey	26	Wanda	26
Dotson	26	Seaforth	27
Sanborn	26	Vesta	27
Lamberton	26	Garvin	26
Revere	26	Belaton	26
Walnut Grove	26	Burchard	26
Tracy	26	Tyler	27
Amiret	26	Lake Benton	27½
Heckman	26	Verdi	27½
Marshall	26	Arco	27½
Ghent	27	Ivanhoe	27½
Minneota	27½	Hendrick	27½
Taunton	29	St. Peter	27
Porter	30½	Gambria	26
Canby	31	New Ulm	26
Burr	31	Essig	26
Evan	26	Sleepy Eye	26
Morgan	26	Cobden	26
Gilfillan	26	Springfield	26
Redwood Falls	26	Judson	26
Wayburn	26	Courtland	26
Clements	26	Nicollet	26
Wabasso	26	Oshawa	26
Lucan	26	Traverse	26

Shippers in the Ashgrove, Mo., district complain that they are unable to compete with kilns at Hannibal and related points, due to the fact that there are no through rates published from the Ashgrove district. The proposed rates are based 6½c over the rates in effect from Hannibal.

TRUNK LINE ASSOCIATION DOCKET

14026. **Rip rap stone,** carload, minimum weight, 90 per cent of marked capacity of car, except when car is loaded to cubical or visible capacity, actual weight will apply, from Croxton, N. J., to Beach Haven and Ship Bottom, N. J., $2.20 per net ton. Reason—Proposed rate compares favorably with rate from White Haven, Pa., to West End, N. J., as well as rate from Raven Rock, N. J., to Beach Haven, N. J. File 42989.

14029. **Crushed stone,** carload, minimum weight, 90 per cent of marked capacity of car, except when car is loaded to cubical or visible capacity, actual weight will apply, from Verona, Va., to Harrisonburg, Va., 70c per 2000 lb. Reason—To place shippers at Verona, Va., on a competitive basis with construction companies who employ road crushers at point where road construction work is in process. File 42964.

14030. **Gravel and sand,** other than blast, engine, foundry, glass, moulding or silica, carload, from Star Brick, Pa., to Sherman, Mayville, N. Y., 90c, Salamanca, N. Y., 91c, and Dunkirk, N. Y., $1.05 per 2000 lb. Reason—Proposed rates compare favorably with existing rates from and to points in the same general territory. File 42961.

14031. **Gravel and sand,** other than blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, moulding or silica, carload, from Ambridge, Baden, Freedom and

Rochester, Pa., to Scenery Hill, Pa., $1.25 per 2000 lb. Reason—Proposed rate compares favorably with existing rates from and to points in the same general territory. File 42960.

SOUTHERN FREIGHT ASSOCIATION DOCKET

29440. **Sand, silica,** from Ohio River Crossings to Macon and Rome, Ga., and Carrollton, Ga. In lieu of Class "A" rates, it is proposed to establish commodity rates on sand, silica, carloads, minimum weight 60,000 lb., from Ohio River Crossings to Macon and Rome, Ga., made same as now published on molding sand, carloads, with rates to Carrollton, Ga., same as proposed to Macon, Ga.

29456. **Sand and gravel** from Old Dominion Siding, Va., and Ellerslie, Va., to South Emporia, Va. Present rate, 94.8c per net ton. Proposed rate on sand and gravel, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern from and to points mentioned, 81c per net ton, made by use of scale submitted by carriers to the Alabama and Georgia Public Service Commissions for single line application over trunk lines, less 10%.

29459. **Fluxing stone,** from Black Fox, Tenn., to Copper Hill, Tenn. In lieu of lowest combination rate, it is proposed to establish through rate of 172c per net ton on fluxing stone, crushed or broken (marble spalls or waste marble), carloads, minimum weight marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, from Black Fox, Tenn., to Copper Hill, Tenn.

29466. **Sand and gravel** from Knoxville, Tenn., to Atlanta, Ga. In lieu of rate of 126c per net ton it is proposed to establish the following rates on gravel and sand, as described below, from Knoxville, Tenn., to Atlanta, Ga. (In cents per net ton):

Description No. 1	140
Description No. 2	130
Description No. 3	130

Description No. 1—Gravel, washed, minimum weight marked capacity of car.

Description No. 2—Gravel, unwashed, minimum weight marked capacity of car.

Description No. 3—Sand, common, other than molding, straight, or sand and gravel, unwashed, mixed, minimum weight marked capacity of car.

The proposed rates are made not less than would result by use of the Georgia Commission's prescribed scale.

29584. **Stone, broken,** from Rock Springs, Ala., to Mobile, Ala. In lieu of present rate of 210c per net ton, it is proposed to establish intrastate rate of 180c per net ton on stone, broken or crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Rock Springs, Ala., to Mobile, Ala., same as present rate from Lagarde, Ala.

29586. **Sand and gravel** from Jackson's Lake, Prattville Junction, Coosada and Oktamulke, Ala., to West Farm and Lee, Fla. Combination now applies. Proposed rate on sand and gravel, in straight or mixed carloads, minmum weight 90% of the marked capacity of car, except when cars are loaded to their visible capacity, actual weight will apply, from the points mentioned to West Farm and Lee, Fla., 189c per net ton, same as recently approved for application from Montgomery, Ala., and also the same as the present rate from those points to Madison, Fla.

29589. **Gravel,** from Millport, Ky., to stations on the L. & N. R. R., M. H. & E. Branch. In lieu of rate of 90c per net ton, it is proposed to establish rate of 63c per net ton on gravel, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight shall govern, from Millport, Ky., to Hartford, Ky., made with relation to rates in effect from I. C. R. R. stations, such as Owensboro, Tipton, Gravel Switch and Major, Ky., to Beaver Dam, Ky. The proposed 63c rate to also apply as maxima to the following intermediate stations—Centertown, Kronos, Smallhaus, Moorman, Bremen and Lynn City, Ky.

29630. **Crushed or broken stone,** from Mascot, Tenn., to L. & N. R. R., Lebanon Branch, Kentucky Division and Knoxville Division stations. In lieu of combination rates, it is proposed to establsh through rates on stone, broken, crushed, rubble and ballast, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Mascot, Tenn., as follows: To Lebanon Branch stations, rates ranging from 164c per net ton to Pinehill, Ky., to 184c to Shelby City, Ky. To Kentucky Division stations, rates ranging from 154c per net ton to Dortha, Ky., up to 184c to Fort Estill, Ky. To Knoxville Division stations, rates ranging from 94c per net ton to Vestal, Tenn., up to 124c to Etowah, Tenn. The rates proposed are made on the same basis as observed when establishing rates under Submittal 21343, from Mascot, Tenn., to L. & N. R. R., Knoxville and Cumberland Valley Divisions' stations.

ILLINOIS FREIGHT ASSOCIATION DOCKET

3791-B. **Sand and gravel,** carloads, from Forreston, Ill., to T. P. & W. R. R. stations, viz., Chatsworth, Gilman and Watseka, Ill. Rates per net ton: Present, combination basis; proposed, 114c.

3883. **Sand and gravel,** carloads, from Jedburg, Mo., to various points in Illinois.

	Rates per net ton	
To— (Representative points	Present	Proposed
Fountain	*	$ .85
Prairie Du Rocher	*	1.00
Chester	*	1.10
Murphysboro	*	1.30
Zeigler	*	1.40

*Combination rates.

3886. **Sand and gravel,** carloads, from Spring Valley, Ill., to Kirkwood, Ill. Rates per net ton. Present, $1.13; proposed, $1.01.

WESTERN TRUNK LINE DOCKET

5735. **Sand, gravel and crushed stone,** carloads, between Council Bluffs, Ia. (when originating or destined points west thereof). Rates in cents per ton of 2000 lb.

And—	Pres.	Prop.
Ft. Dodge, Ia.	122	*
Iowa Falls, Ia.	158	*
Cedar Rapids, Ia.	158	*
Waverly, Ia.	158	*

*Cancel present rates and establish through rates on basis approved in W. T. L. Rate Advice 6935, i.e., Nebraska joint line distance scale as provided in W. T. L. Tariff 175.

Minimum weight 30,000 lb.

3545-P. **Sand,** carloads, from Kansas City, Mo. (applicable only on interstate traffic), to points in Missouri on interstate traffic. Present, as shown in C. B. & Q. C. F. O. 2173-I and 9500F; proposed, rates on basis of 20c per ton higher than the Missouri state rates, for example:

To—	Pres.	Prop.
Albany, Mo.	$1.40	$1.30
Forbes, Mo.	1.30	1.15
St. Catherine, Mo.	1.40	1.35
Utica, Mo.	1.30	1.20

Minimum weight 90% of marked capacity of car, except that when cars are loaded to visible capacity actual weight will be the minimum, but not less than 40,000 lb.

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

11061. **Sand,** building, common or run of bank, carloads, minimum weight 90% of marked capacity of car, except when the combined weight of car and lading exceeds the published maximum weight limits, in which case the minimum weight will be the maximum weight that can be transported via the direct route to the destination point without exceeding the maximum weight limit, from Auburn, Mass., to stations on the N. Y. N. H. & H. R. R. in various directions up to 30 miles, 70c per net ton. Reason: To apply same basis of rates as in effect from other sand shipping points.

11064. **Lime,** carloads, minimum weight 40,000 lb., from Ashley Falls, Great Barrington, Lee, Pittsfield, Sheffield, West Stockbridge, Mass., Canaan, Danbury, East Canaan, New Milford and Redding, Conn., to stations on the Boston & Maine, Boston & Albany, Central Vermont Ry. and Maine Central Railroads. Reason: To provide same minimum weights as are now in effect from shipping points on the Boston & Albany, Boston & Maine and Maine Central Railroads to points on the New York, New Haven & Hartford Railroad.

Sand and Gravel Rates to Chicago Inner Zone

A FINDING of undue prejudice, but not unreasonableness or unjust discrimination, with a denial of reparation, has been recommended by Examiner Paul O. Carter in No. 17188, sub-No. 3, Chicago Fire Brick Co. vs. Chicago and North Western et al., as to rates on sand and gravel, from Janesville, Afton and Beloit, Wis., to complainant's plant in the Mayfair district in Chicago, between July 2 and November 2, 1923, and to its plant in the Weber district, between June 19, 1923, and May 24, 1925. He said the rates should be found unduly prejudicial to the extent they exceed those to the so-called inner zone in the Chicago switching district. He said as no damage had been shown to have resulted from the undue prejudice, reparation should be denied.

Rates on Gravel Illegal

EXAMINER PAUL O. CARTER in a proposed report in No. 16799, Allen Gravel Co. vs. Chicago, Rock Island and Pacific et al., has recommended that overcharges be ordered refunded on a finding that rates charged on gravel from Gravel Siding, Miss., to destinations in Arkansas were illegal. The examiner said the commission should find that the rates charged from Gravel Siding, Miss., to destinations in Arkansas since September 8, 1924, were illegally assessed and that the applicable rates were and are the combination of the rate from Gravel Siding to Memphis, Tenn., and the rates from Memphis to the destinations in Arkansas, reduced in accordance with the provisions of the rule for constructing combination rates in B. T. Jones' Tariff I. C. C. No. U. S. 1, formerly published by Agent Kelly.

Gravel Rates Unreasonable

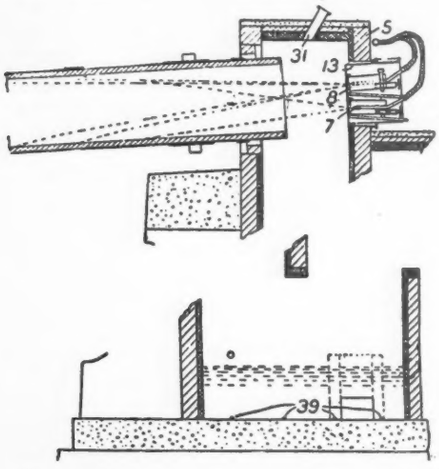
A FINDING of unreasonableness and an award of reparation have been recommended by Examiner W. M. Cheseldine in No. 17460, Luten Bridge Co., Inc., vs. Atlantic Coast Line et al., as to rates on gravel, from Montgomery, Ala., to Barney, Ga., between January 10 and May 21, 1924. He said the commission should find the rates unreasonable to the extent they exceeded $1.76 per net ton and award reparation to that basis. The examiner said that the conclusion recommended by him should be without prejudice to any that might be reached in the cases consolidated with formal docket No. 17517, in which the question of rates on gravel is under consideration.

Baltimore Lime Rates Prejudicial

IN No. 17374, Washington Building Lime Co. vs. Pennsylvania et al., mimeographed, the commission, by division 4, found rates on lime, from Woodville, Ohio, to stations on the Western Maryland, in Baltimore, east of Walbrook, unreasonable and unduly prejudicial. It found a rate of 25.5c plus switching charges or reconsigning charges unreasonable and unduly prejudicial to the extent they exceeded, exceed or may exceed the rates and charges to other destinations in Baltimore. Fifty cents per ton for Western Maryland delivery were added to the charges accruing under the 25.5c rate to other destinations in Baltimore. A similar situation was dealt with in Woodville Lime Products Co. vs. Pennsylvania, decided July 19, 1926. In that case the commission gave the carriers 60 days in which to publish the 25.5c rate to Fulton station in Baltimore. No order was issued in this case but the commission told the carriers it expected them to establish the 25.5c rate to points east of Walbrook over the route over which it was established to Fulton station.

Current Abstracts of Foreign Literature

Cement Making Process. The illustration exemplifies a process in which cement is burned on the principle that the material in the form of a powder is distributed in the upper part of a rotating furnace in such a fashion as to become partially dried before it comes in contact with the walls of the furnace. Thus a particular characteristic of the invention is the distribution of the unburnt cement



Dry powdered raw cement is distributed in the upper part of the kiln and then blown against the kiln walls

powder over a large area of the wall of the kiln by means of one or more tuyeres, which are seen at 7 and 8 in the figure. A second characteristic consists in placing the tuyeres on the outside of the furnace, for example, in a chamber 13. Then again an auxiliary feeding tuyere can be placed in the roof of the chamber at 31 which will then be used only when the other tuyeres are out of order. *British Patent No. 243,410.*

Aluminous Cement. In the manufacture of a cement which contains a considerable proportion of alumina, the starting point is a substance which is rich in aluminous ingredients, such as a bauxite. This mineral is mixed in the proper form with such fluxes as alkalies and iron compounds, and the mixture then melted down in a suitable kiln. The molten mass is then further smelted in the Siemens type of open hearth furnace after admixture of blast furnace slag. *German Patent No. 429,553.*

Dehydration of Gypsum. A process for the dehydration of gypsum consists in treating the mineral with steam at a pressure of 10 to 11 atmospheres. This treatment is advantageously carried out in large chambers which are closed tightly so that the steam does not have an opportunity to escape. The crude material is generally placed in small cars in this room. *French Patent No. 606,241.*

Theory of Hardening of Hydraulic Cements. It is admitted today that since the experiments of Le Chatelier the crystallization, which takes place at the same time as the hardening of cements, results from the transitory supersaturation of soluble compounds, and that this supersaturation is due to the greater solubility of the anhydrous compounds. In accordance with certain experiments which were made on this subject, the phenomenon appears to be more complex. The preliminary hydration of the anhydrous constituents of cement will first give colloidal hydrates, and then the crystalline gel, which is produced in this manner, is converted into an aggregation of large crystals, which is due to the greater solubility of the larger crystals over those of small dimensions.

It is therefore possible to describe three successive stages in the hardening of cement: (1) solution during which the liquor becomes progressively saturated with various soluble elements; (2) colloidizing during which all the products of the chemical reaction form in the colloidal condition. This corresponds to the beginning of the set and (3) crystallization, during which the gels are converted into crystalline aggregations. This is the period during which hardening proper takes place. *Comptes rendues,* **182,** 128-129.

Recovery of Heat from Cement Kilns. Study has been made of the heat losses involved in the normal cement burning process. It is indicated at the outset that the average large cement kiln utilizes to advantage only one-third of the heat that is fed to it. The remainder goes to waste. Thermal calculations are made on this subject.

A cement kiln of the rotary type, making 200 metric tons (about 1100 bbl.) of clinker per day, will emit into the atmosphere approximately 23 cu. m. (810 cu. ft.) of hot gases per second. These gases go to waste. It is only within recent years that any serious attempts have been made to recover this heat and use it to good advantage. Since then the results have been really astounding and considerable development has taken place along these lines both in Europe and in the United States.

Statistics are given on a cement mill which operated two kilns, three meters in diameter and 45 meters long (10x150 ft.). The recovery of heat was carried out in a waste heat boiler which contained 1425 sq. m. (13,500 sq. ft.) of heating surface and 65 sq. m. (750 sq. ft.) of superheater surface.

The gases were sent through this apparatus by means of a suitable blower. The consumption of coal per metric ton (2240 lb.) of cement was 250 kg. (550 lb.). The hot gases were removed at a temperature of 735 deg. C. and they arrived at the waste heat boiler at a temperature of 690 deg. and left it at a temperature of 219 deg. C. The two kilns received 37,500,000 calories of heat per hour. The burning of the cement required 14,100,000 calories and the waste heat boiler recovered 9,600,000 calories. The boiler produced 14,500 kg. (31,900 lb.) of steam at a pressure of 10 kg. per sq. cm. (142 lb. per sq. in.) and with 83 deg. of superheat.

The thermal efficiency of the cement burning operation without recovery of the waste heat was 37.6%, and after recovery it rose to 63.1%. *Revue Ingenieur,* **23,** 84 to 90.

Thurament.—A new hydraulic binding agent known as Thurament and which can be used, for example, in the making of an artificial tarras is made of cooled basic slags. (The composition is shown in the original article in the form of a diagram in comparison with other mortars.) Bases, such as magnesia and lime, together with the hydraulic ingredients, silica, alumina and iron oxide (Fe_2O_3) are present in this substance in equal proportions. The mixture becomes hydraulic with small proportions of lime. The strength of this mixture is small at the beginning, but increases until it is rather good. In the original articles figures are given on its strength, proportions used in making the stone, resistance to acids, time of setting and degree of contraction. Curves are also given and details of the possible uses of the material are described. *Tonindustries Zeitung* (1926), **50,** 901-2, 948-50, 960-1.

Gypsum and Magnesite Cement Compositions.—Plastic compositions are made to contain gypsum and magnesite cements as well as bituminous materials. Thus a material for building and other purposes is made by adding a colloidal solution, emulsion or suspension of bituminous, oily, fatty, waxy or resinous substances, or mixtures of the same, to substances which harden with water, such as magnesite cement, gypsum or mixtures containing these substances. As an example, an emulsion containing 50% of asphalt is added to a mixture of magnesite, magnesium chloride and sawdust until the total mass contains 20% asphalt. For a light colored material paraffin is used instead of asphalt. Ozokerite, ceresin and other mineral, vegetable or animal oils, fats or resins or mixtures of them may be similarly used. *British Patent No. 252,711.*

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Brick and Block Plant Makes Economical Use of Excess Limestone Screenings

The Carbon Concrete Brick Co., a Sister Company of the Carbon Limestone Co., Hillsville, Pa., Now Operating New Plant

By George M. Earnshaw

FOR many years The Carbon Limestone Co. at Hillsville, Penna., has been piling up "screenings" and for no mysterious reason the pile failed to get smaller, although several carloads were shipped weekly, in the form of finely ground agricultural limestone. It finally dawned on officials of the company that the several hundreds of thousands of tons could well be consumed by a concrete products plant.

Tests of the material showed it to be ideal for the manufacture of brick, block and tile. Compression tests made by the Pittsburgh Testing Laboratories showed it to run as high as 2425 lb. per square inch and absorbtion tests (of brick made on the power machines) showed under 4%. Both of course, are excellent, especially the absorbtion test.

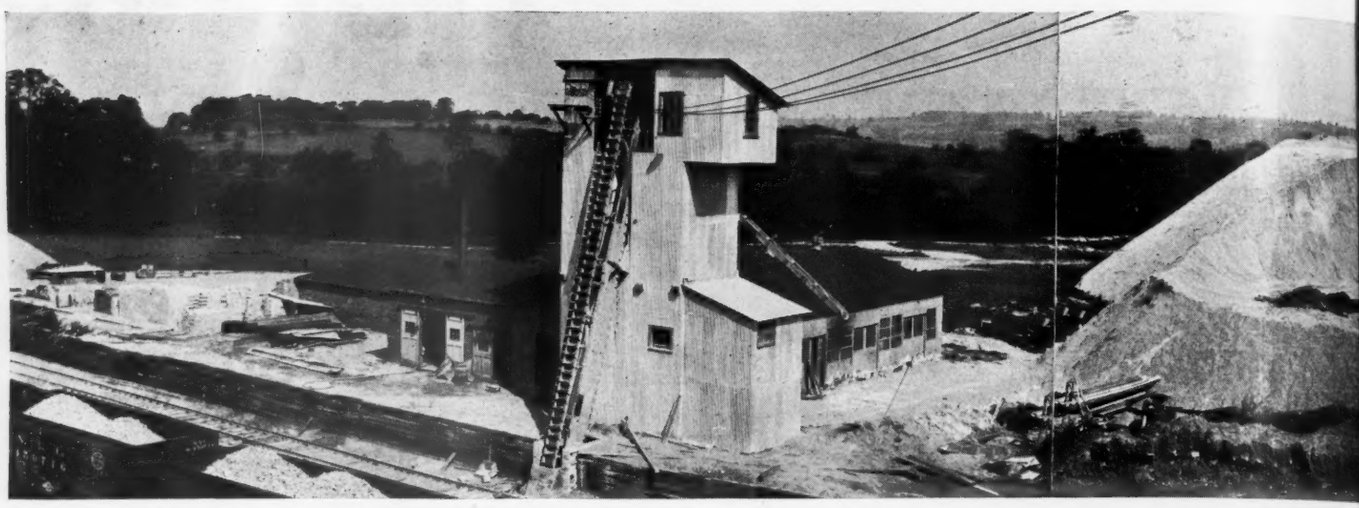
Interior of the Carbon Concrete Brick Co. new plant

Following the decision to go into this new business, officials of the company organized a company, known as The Carbon Concrete Brick Co., with headquarters at 1005 First National Bank Building, Youngstown, Ohio. Mr. Robert Bentley, president of The Carbon Limestone Co., was elected president; M. S. Logan, secretary - treasurer, and Fred O. Earnshaw, vice-president and general manager.

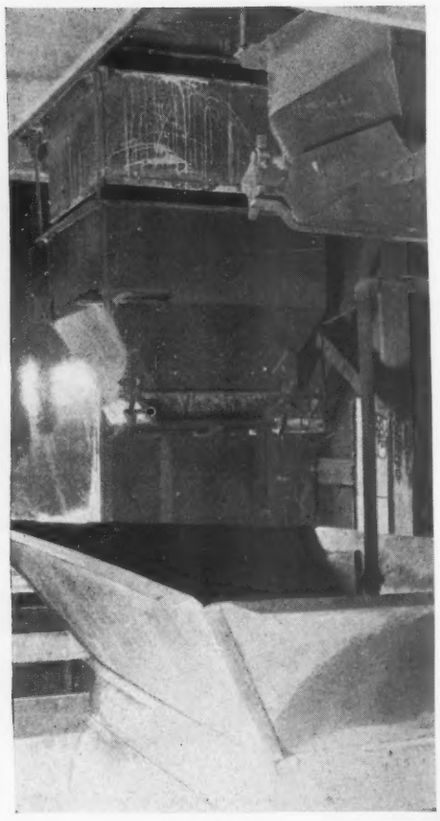
The first step taken was the purchase of the Shope process, manufacturing rights, and five machines (for face brick) for the border counties of northeastern Ohio, and western Pennsyl-

Several of the curing rooms, each of which has a capacity of 15,000 brick

Trucks loaded with green brick entering one of the curing rooms



Panorama shows the new plant and a portion of of the several hundreds



Batcher tank and mixer. Cement is added by hand

vania, as the plant is located almost on the border line of these two states. This territory offers a rich market owing to the fact it is within trucking distance of Youngstown, New Castle and other fair-sized cities. The marketing plan includes delivery to the contractor or home builder, thus eliminating a middleman's profit as well as much handling.

The Plant

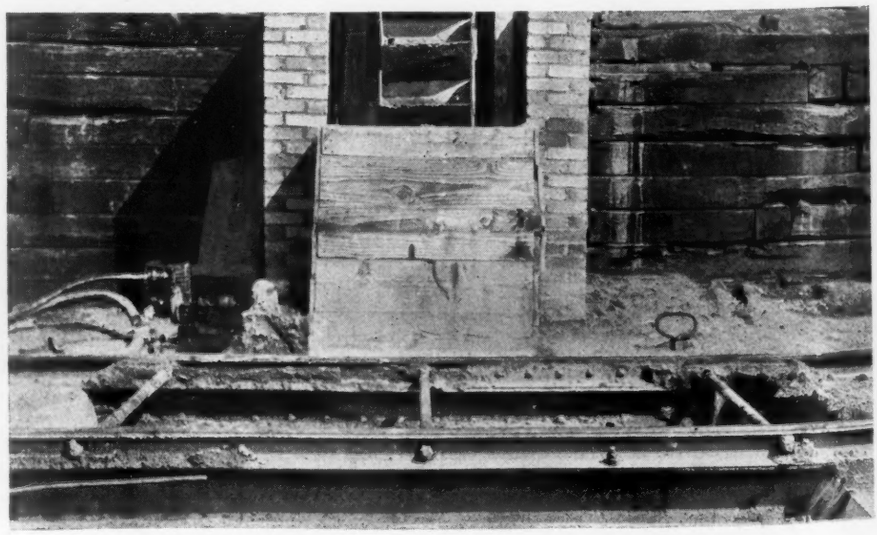
The aggregate is reclaimed from storage by a 20-ton Brownhoist locomotive crane, equipped with a 50 ft. boom and 1½ yd. clamshell bucket. This machine loads into hopper-bottom railroad cars, which are moved to the plant over a track paralleling the storage. The cars dump into a 8x12 ft. steel lined track hopper, 12 ft. deep. (This pit is drained by a 1¼-in. Deming centrifugal pump driven by a ¾-h.p. Wagner electric motor. The pump operates automatically, being fitted with a float valve located in a sump below the bottom of the pit.)

The plant itself is well constructed, the mixing plant, conveying system and machines being housed by a standard type all-steel Truscon building. The curing rooms and boiler plant are, of course, of Carbon concrete brick and concrete construction. With the exception of the design of the steel building and the installation of the machines, the plant was designed by the company's own engineers.

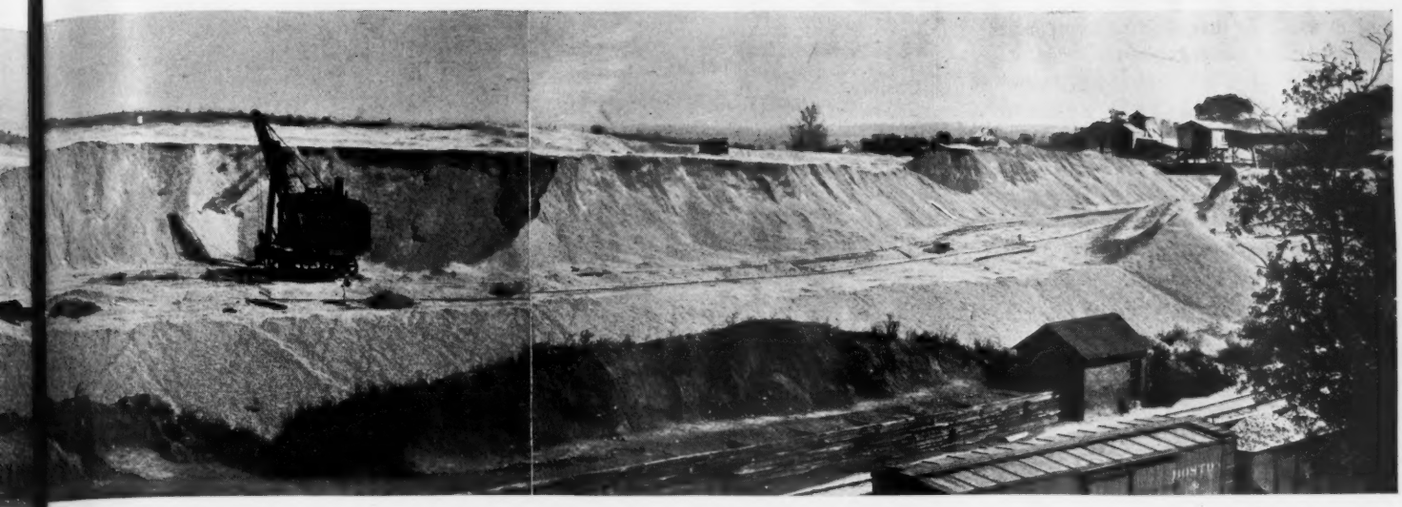
The screenings are fed from the pit through a slide gate to a 20-in. belt-bucket elevator of approximately 50-ft. centers. From it the material passes to a knocker screen (of local design and construction) which takes out everything, over ¼-in. This material is spouted to outside storage where later it is reclaimed by the crane and returned to the agricultural limestone plant. The material passing through the screen is chuted into a wooden bin of about 65 cubic yds. capacity, covered inside and outside with galvanized iron.

From this bin the aggregate moves by gravity to a 15 cu. ft. Blaw Knox batcher tank, so that uniformity of the mix is assured. The batcher empties into a Blystone mixer of 15 cu. ft. capacity and here two sacks of cement are added by hand. A 3 to 5 cu. ft. capacity Blaw Knox batcher, together with provisions for storage for bulk cement have been installed, but as yet have not been used, as it has proven to be more convenient to handle bagged cement. Later however, the bulk handling system will probably be put into operation.

The mixer discharges from the side and is controlled by a lever. Its mixing motion affords a gradual but positive feed of the concrete to the conveyor. A 20-in. Republic belt of 70-ft. centers runs overhead



Close-up of track hopper and elevator



of thousands of tons of screenings which will be consumed by it

More of the large piles of screenings. On the right-hand track may be seen cars of screenings being unloaded to storage

and distributes the concrete to the machines. It is installed in such a way that it can be lengthened if additional machines are later installed. The conveyor and the mixer are both driven by a 15-h.p. General Electric motor.

There are four brick machines and one block machine now in use, while a fifth brick machine is being installed. They are of the Heskett automatic hydraulic power type and were furnished by the A. J. Heskett Concrete Machinery Co., Williamsport, Pa. One 5-hp. Wagner motor drives two machines, the motors and drive shaft being mounted overhead on a 5-in. angle iron hung from the building's truss.

The brick machines as now installed are producing 650 floated-face brick per hour and the block machine has produced as high as 100 blocks per hour. Two off-bearers truck the finished product to the curing rooms, using rubber-tired hand trucks.

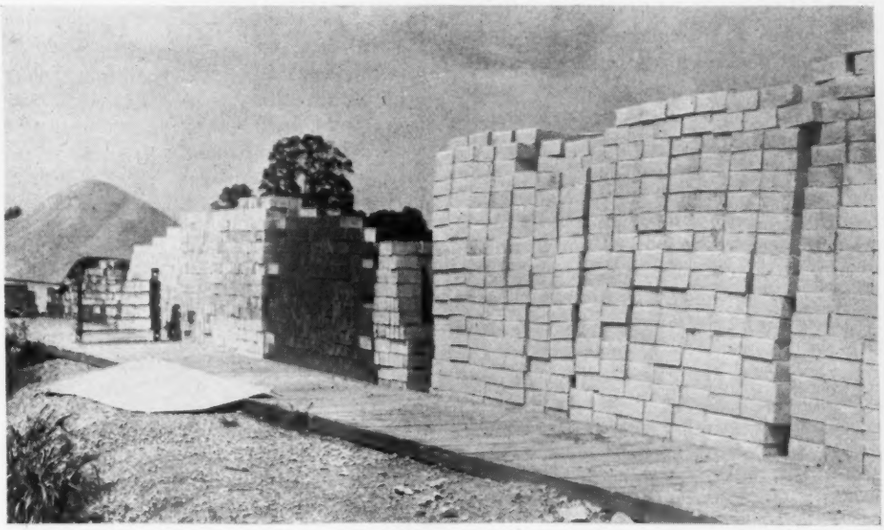
As the brick and block are taken from the machines they are placed on steel pallets. These are self-racking and the usual truck load is eight pallets. This system of handling makes the operation more flexible, for it eliminates the necessity for steel track, cars and turntables for handling green block.

There are six curing rooms of 15,000-brick capacity each. Steam is supplied by a 40-h.p. Erie City horizontal boiler. Perforated pipes carrying steam extend through the concrete water troughs in the curing rooms for supplying vapor necessary to the curing process. Approximately one-half mile of 1¼ and 1½-in. pipe are used in the steam coils.

The plant is producing many kinds and colors of brick, including smoothface, rugg-face, stipple face and fine, medium and coarse wire cuts. In all, there are 32 different shades and color combinations so that practically any desired color or combination of colors may be had, making it easily possible to match brick in an old building.

It is worthy of mention here that the brick are unusually hardy, as may be observed in watching the careless loose loading and dumping of the motor trucks. The company is now constructing a covered storage for the finished product which will accommodate three millions of brick.

Only twelve men are required to operate the plant. This includes the five machine operators, two off-bearers, one mixer operator, two laborers for loading trucks and cars



Piles of finished brick in storage yard

and cleaning up around the plant, one mechanic and the superintendent. The plant, we think, is an excellent example of what can be done in the concrete-products industry by a quarry or sand and gravel operation where disposition of excess material is a problem.

Reinforced Concrete Culvert Pipe Specifications

THE following are some of the important points presented by committee J-2, on reinforced concrete culvert pipe at the 1926 American Concrete Institute convention. The quality of the cement was to meet A. S. T. M. requirement. Aggregate should be clean and well graded. The fine aggregate should pass 100% thru ¼-in. screen. The uniform load for the pipe so made (according to formula and design) should be at least 2500 lb. and for extra reinforced 4000 lb. per sq. ft. respectively. The concentrated load to be considered as two-fifths of the uniform load.

Disintegration of Limestone Closely Allied to That of Concrete

PROFESSOR A. P. LAURIE, Edinburgh, as Professor of Chemistry at the Royal Academy, London, delivered a lecture on "Some English Cathedrals and Stone Decay." Professor Laurie began by stating that for some years he had been making observations at the request of the Office of Works on the stone decay taking place in our ancient monuments. During this time he had collected a good deal of interesting information, and during the last summer he determined to visit some of our cathedrals with a view to collecting further facts. The cathedrals visited were Durham, Lincoln, Ely, and Norwich, and in addition he re-examined the condition of the stone at Hampton Court and the Houses of Parliament, and paid a visit to Westminster Abbey. Before speaking of these buildings, he began by referring to the ruins of Elgin Cathedral.

"In order to understand what is happening here and elsewhere it is necessary to classify the stones used for building into three main groups—the limestones, the sandstones in which the quartz particles are united by calcite, and the sandstones in which the particles are united by silica. This classification would be regarded by petrologists as wanting in detail and being somewhat diagrammatic in character, but it will be the most convenient for our present purpose, which is the injury caused to modern buildings by the presence of sulphur dioxide in the air produced by the burning of coal. The ordinary causes of stone decay do not require special mention here, as they are well known to architects and builders, but the new and the main cause of rapid decay taking place in modern buildings is the attack on the calcium carbonate of the limestone and of the calcite forming the binding material in sandstones by sulphur dioxide in presence of air and moisture forming calcium sulphate. Calcium sulphate is slightly soluble in water, and therefore is being slowly dissolved in the rain and removed, but this is not the most serious cause of damage. Cases of rapid decay are found to be associated with the crystallization of calcium sulphate inside the stone, and the consequent breaking up of the stone."

The lecturer showed micro photographs of calcium sulphate crystals and magnesium sulphate crystals from Ely and from the Houses of Parliament respectively, and described experiments for producing the same effect in the laboratory. Proceeding then to deal in detail with the stone decay taking place at Elgin, Durham, Lincoln, and Ely, he directed the attention to the fact that in some cases where siliceous sand stones had been used the source of lime must have been the mortar, the rain dissolving and washing the lime into the stone. He also showed from the analyses at remote places like Ely and Tintern Abbey that the destruction owing to sulphur dioxide was not confined to the towns but was spread over the remote country districts. Finally he stated as the results of the evidence collected that probably the best thing that could be done would be to treat such stone surfaces with a binding material, depositing silica cement, and periodically to wash down the building with water during the summer with a view to removing the excess of sulphate of lime, and thus diminish the danger of crystallization. While it was not possible in the state of our present knowledge to say whether such washing could be safely applied to every variety of limestone experiments in this direction are well worthy in his opinion, of the serious consideration of architects.—*Stone Trades Journal, London, England.*

Loading brick into trucks right from the curing rooms at the Carbon Concrete Brick Co.

Cement Products Coating

A NEW compound known as "Teratex," for surfacing or coating concrete units has been recently put on the market by the Crystal Building Products Corp., Chicago, Ill. It is applied in liquid form either on the green product or on the set unit, which, however, should be moistened before application. The surface produced on the product, the manufacturers say, is waterproof, hard and does not check nor craze.

Teratex is supplied in four different colors and in dry powder form in metal containers which only needs the addition of mixing water to be ready to apply. One gallon is said to be sufficient to cover 75 sq. ft. of surface.

New Products Plant for Savannah

ANNOUNCEMENT is made in the Savannah (Ga.) *Press* of the formation of the Georgia Concrete Products Co. to manufacture ornamental cement products and building units. The company is reported to have secured a factory site of about three acres on which a plant will be erected, to start production early in December. Universal machines will be used, it is said. Management and control of the company will be in the hands of local business men headed by Major M. W. Dixon, Jr.

Technology of Mica

W. M. MYERS, associate mineral technologist, Bureau of Mines, recently conducted an extensive field study in the mica districts of South Dakota, Montana, Idaho, Washington, California and New Mexico. Considerable information was accumulated on the technology of mica production and manufacture, which will be assembled in a report on this subject to be issued at a later date by the Bureau.

Certain-teed Products To Build Oklahoma Gypsum Plant

A RECENT report in an Oklahoma City newspaper states that the Certain-teed Products Co., New York, have purchased a large deposit of gypsite near Mangum, Okla. Preparations are being made, it is said, to erect a 300-ton plaster mill near the deposit.

Enwood Sand and Rock Co. to Double Capacity

ACCORDING to a recent announcement in a local newspaper, the Enwood Sand and Rock Co., Roseville, Calif., are to erect another plant near the one they already operate. The new plant is to be a duplicate of the old with some few changes such as the substitution of a large and modern power shovel in place of the dragline system at the old plant. These changes are necessary because of the nature of the material which the new plant will use which is about 80% rock and 20% sand.

After having conducted the Enwood company as a pit-run sand and gravel industry for about 16 years, the owners, Messrs. Ennis and Brown, decided about three years ago to convert their enterprise into a modern washed sand and crushed rock plant. The conversion was accordingly effected during the summer of 1924 and the new plant, erected at a cost of over $100,000, began operating early in September of that year.

As the old Enwood Sand Co. had been marketing more sand than gravel, the proprietors naturally drew the conclusion that the demand for sand would be greater than that for the other products of the plant. Accordingly the company, who own about 700 acres of land through which passes Secret and Miners ravines, as well as the old channel of the American river, located their plant at a point on their property where the percentage of sand was larger than gravel and rock, the former running about 80% and the latter 20. After operating the plant for a year or more, their reserve stock of sand grew rapidly, while they were unable to produce sufficient quantities of crushed rock to meet the demand, to say nothing of accumulating a surplus. During the past six months the company has been obliged to turn down orders for not less than 150,000 tons of crushed rock which it was not able to supply.

In view of this, the proprietors began casting about for means of reversing the order of production. A number of prospect holes were sunk at various points on the company's property in a northeasterly direction from the present plant and a tunnel was driven a little above the level of Miners' ravine into one of the hills. These prospect holes and tunnel were made to determine the relative percentage of sand and rock contained in the deposits. The prospecting was done with a view to following the old channel of the American river.

A number of truck loads of material excavated from these prospect holes were hauled to and run through the plant and it was found that the percentages of sand and gravel were just the reverse of those contained in the present workings, running 80% rock and 20% sand. Samples of the products were then sent to various laboratories and the California State Highway Commission for quality tests and were found, it is said, to be quite satisfactory.

The tests being completed and quality found up to grade, the company then decided to enlarge the plant capacity by the erection of a new plant on the new location. The plans are now being completed and construction work expected to begin in time to have it in operation to meet the next season's demand. Arrangements have been made with the Southern Pacific railroad for construction of a spur track from its main line to the new plant and another narrow gage railroad will be built to haul the excavated material to the plant.

The present plant output is about 1,500,000 tons per year of washed, screened and graded bank and river sand and gravel. E. S. Brown and S. F. Ennis are the owners of the company, E. J. Goodfellow is general manager and H. W. Flint, superintendent. The office is maintained near the plant at Roseville.

Vorhis Made Superintendent of Elliston Lime Company

ACCORDING to recent announcement, J. W. Vorhis has been made superintendent of the Elliston Lime Co., Helena, Mont. He will be in full charge of the plant which includes the quarry operations as well as the lime plant and the new hydrating unit which was put in operation last year.

Mr. Vorhis has had a wide experience in lime manufacture and the quarrying industry. Recently he was in charge of operations at the municipal quarry at Quincy, Ill., which was taken over by the Bauer-Johnson Co. of Omaha, Neb.

J. W. Vorhis

Earl Zimmerman Advances

THE directors of the Ohio Gravel Ballast Co., Cincinnati, Ohio, at their recent annual meeting elected Earl Zimmerman president of the company. Mr. Zimmerman had been vice-president and general manager for the past few years.

Mr. Zimmerman is one of the best known men in the rock products industries, having served as chairman of several important committees of the National Sand and Gravel Association. He is also president of the Ohio Sand and Gravel Producers' Association. There is little doubt that his wide experience and ability will enable him to successfully carry on in his new office.

Phosphate Company Increases Production

THE Cokeville Phosphate Co., operating at Cokeville, Wyo., recently announced that it has materially increased production to meet an excess of orders from the Pacific coast.

The phosphate mine at Cokeville is considered as a mine of some consequence in the Rocky Mountain region. It began operation in 1923, shipping only four cars of the product that year, however. Four hundred cars will be shipped this year and plans are being made for an ultimate production of 500 tons per week.

It has been estimated that deposits are sufficient to allow the shipment of a hundred cars daily for the next thirty years.—*Laramie (Wyo.) Republican.*

Bethany Quarry Flooded When Dam Gives Away

FOLLOWING unusually heavy rainfall which flooded both branches of Big Creek near Bethany, Mo., the dam separating the quarry of the Bethany Crushed Stone Co. f om the junction of the branches gave way and allowed the overflow water to pass into the quarry pit. The company's two crushers, two electric motors and three trucks were all under water. After the creek had gone down to normal, the dike at one part of the quarry was cut down to drain out as much of the water as possible and the pumps set to work to pump out about 15 ft. of water remaining in the deepest part of the quarry.—*Bethany (Mo.) Clipper.*

Fire at Ruhm Phosphate Plant

A RECENT fire at the plant of the Ruhm Phosphate and Chemical Co., Mt. Pleasant, Tenn., caused considerable damage. The plant had been in continuous operation for about a month and there were several thousand tons of ground rock phosphate in storage, which will be recovered. Arrangements have been made with another producer to grind for the Ruhm company until a new plant can be erected on the location.

New Machinery and Equipment

New I-Beam Trolley

THE Northern Engineering Works, Detroit, Mich., announce their new design of I-beam trolley of all-steel construction. The frame consists of two cast sides, held in place by a horizontal steel equalizing load pin. Wheels are of a special car wheel composition and provided with chilled, crowned treads and designed, so it said, to eliminate side thrust friction. Hyatt roller bearings are provided on the wheels. The equalizer pin, it is said, insures equal distribution of the load on all four wheels. Load ring, shafting and other small parts are all of steel.

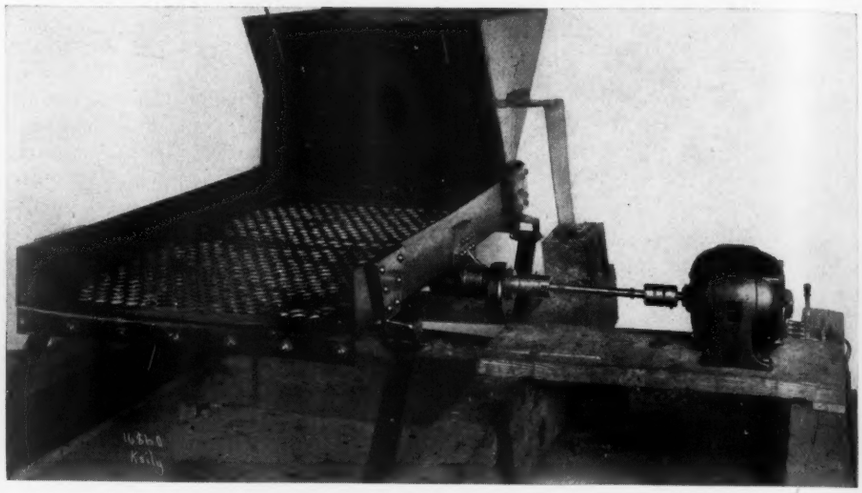
All steel I-beam trolley

The design allows, it is said, for changing the gage or width of the trolley and makes it adaptable for two or three sizes of standard I-beams. Up to and including three tons the trolley is usually furnished without gearing or hand chain and is moved by pushing on the load. Over three tons, gearing and hand chain are recommended for traveling.

New Vibrating Screen

THE Montgomery Coal Washing and Manufacturing Co., Birmingham, Ala., announce their "conveying vibrator" screen for separation of slag, gravel, coke, etc. The screen is installed in a level position and the material to be screened automatically fed on the screen by the vibrations of the screen. This, the manufacturers say, makes it possible to get a uniform amount of the material over the screen at all times. The material moves from the intake to the discharge end at the same time the screen is vibrated.

The construction of the screen is simple. A bin (represented as a hopper in the accompanying cut) holds the material to be screened. The position of the springs causes the material to move with the vibrations toward the discharge end.



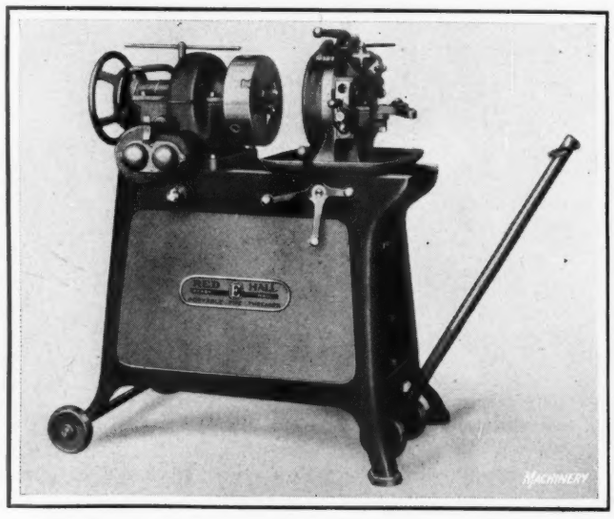
A vibrating screen successfully used for coal and slag

The shaft is mounted in two heavy double ball bearings. The connection to motor is a flexible coupling, hardened and protected from dust. The material can be carried beyond the screen area by attaching a pan to the discharge end of the screen. Also, it is said, the material will travel up a 10% grade with only slight reduction in the capacity of the machine. A 1-hp. motor is said to be sufficient to operate a 4x6-ft. screen of this type. The load on the screen, the manufacturers say, does not affect the motor load for all that the motor does is to rotate the shaft which is unaffected by the load of the material passing onto the screen.

Portable Pipe Threading Outfit

A COMPLETE threading outfit operated by electric power and capable of handling pipe of ¼ in. to 2 in. in diameter and bolts of ½ in. to 1½ in. in diameter is announced by the Hall-Will, Inc., Erie, Penn. As a power unit for doing hand stocks the machine is said to thread up to 12 in. without dismantling. The entire machine weighs but 450 lb. and rests on a built-in truck which can be easily elevated for portable operation.

The "Red-E-Hall," as it is called, is geared for three speeds, the highest speed being for cutting off pipe. The friction clutch for stop and start is operated by a lever handle conveniently placed on top of the machine. The drive to the head stock is through silent chain from the electric motor which is either a.c., 110-220 v. or d.c., 115-230 v. These motors are standard equipped, but others using different voltage can be supplied on request. Tunken roller bearings are used throughout.



Portable electric powered pipe threading outfit

The standard equipment besides the above-mentioned motors consists of 8 sets of dies ranging from ¼ in. to 2 in., a die-head with micrometer adjustment and interial oiling system; cutting off attachment with high speed cutoff tool; reaming and chamfering attachment for high speed cutting, and other devices.

Resurfacing Rock Products Equipment with Stellite

THE application of Haynes stellite for resurfacing wearing parts of cement mill equipment and other rock products equipment was described in the New Machinery section of the January 23 issue. As was stated, stellite is a non-ferrous alloy consisting primarily of chromium, cobalt and tungsten combined in such a manner that the resultant product has the properties of exceptional hardness, great resistance to abrasion, and is not affected by most acids and chemical compounds.

Stellite for resurfacing parts is put forth

Stelliting a plow arm

in the form of a welding bar and is applied by fusion welding, best accomplished by the oxy-acetylene flame. The process is known as "stelliting." By this means stellite can be applied to steel regardless of the grade or carbon content, alloy steels, and to malleable and cast iron. It can also be used successfully on copper, although the methods to be used here are somewhat different than those used with iron or steel.

In welding Stellite to other metal surfaces, it is essential first to clean the parts thoroughly, preferably by grinding. Then there are three very important things which must be carefully provided for. In the first place, a thorough bond must be secured between the first layer of Stellite and the underlying metal. Second, the technique must be such that there will be no small blowholes or particles of impurity included in the molten Stellite. Third, the work must be so handled that the Stellited section will not crack after the operation is completed.

The first point mentioned above is provided for by the initial "tinning" operation, as will be described; the second, by properly manipulating the welding blowpipe. Surface cracks are prevented by carefully preheating the part for welding and by proper allowances for slow cooling.

Preheating the base metal can be accomplished in the same way that this work is done for ordinary cast iron welding. If the part is large and bulky and the surface great, a temporary firebrick furnace fired with charcoal is usually preferred. A kerosene, gas or crude oil burner can also be used where conditions warrant, and sometimes, when the piece is small, sufficient preheating can be obtained simply from the blowpipe flame. The material in any instance should be brought up to a dull red heat. It is especially necessary that this temperature (which will approximate 1200 deg. F.) be reached and maintained during the entire surfacing process.

The blowpipe should be fitted with a tip of about the size required for cast iron of the thickness of the base metal or about one size larger than that required for steel of the same thickness. Oxygen pressure should be about that usually required for welding on cast iron.

For Stelliting, a flame with an excess of acetylene is always used. This is necessary to prevent oxidizing the Stellite; use of a neutral flame or a flame having a slight excess of oxygen will destroy some of the desired qualities. It is usually recommended that the feathery cone of flame indicating excess acetylene extend about double the length of the true inner cone. Foaming and bubbling of the molten metal will indicate an insufficient supply of acetylene, and the presence of a heavy black carbon deposit will indicate too much.

The blowpipe should be so held that the flame will not blow down into the molten Stellite. This is likely to cause blowholes. For larger surfaces, hold the flame so that it is nearly parallel to the surface on which Stellite is to be deposited for the first time, as shown in the accompanying illustration. If small parts are to be Stellited, the normal position for welding steel must be used, although this decreases the speed of the tinning operation.

Where the surface is of moderate size, the entire surface can be tinned before any building up is done, but where the surface is large, it is recommended that this tinning operation be done in sections. This initial layer of Stellite should be very thin, as with it will be alloyed some of the underlying metal, thus destroying to some extent the characteristics of Stellite. After the first layer is applied, however, subsequent layers can be heavier until a sufficient depth is reached.

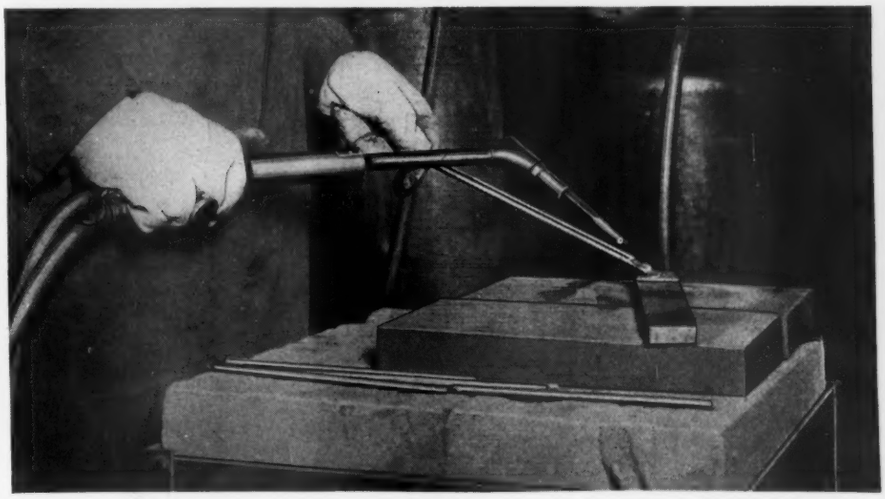
In the tinning operation, the flame should be played on one corner section of the surface until the carbon deposit from the excess acetylene flame disappears and the metal begins to sweat. The Stellite welding rod should be brought to the point of fusion at about this time by holding it in the blowpipe flame; molten Stellite is then applied to the hot surface. If the Stellite does not flow on smoothly, and readily alloy with the base metal, it is an indication that the latter is not hot enough.

After the surface is initially tinned, more Stellite can be added with fair rapidity. Great care must be taken, however, to prevent formation of blowholes and to work out any scale or dirt which may be noticed in the molten metal. This is done exactly as in cast iron welding, but no flux is used.

Throughout all this work, the operator should use great care to see that the puddle of molten Stellite is always enveloped by the outer cone of the blowpipe flame. This protects the molten metal from the air, and prevents oxidation.

In Stelliting cast iron surfaces, it is recommended that a heavy top layer of Stellite be applied. This insures a surface metal of the proper qualities, as cast iron mixes with the first layer of molten Stellite to a greater extent than do other metals.

When surfaces have been Stellited to a sufficient depth, the part should be handled exactly as a cast iron part of similar size. It is recommended that the piece be cooled slowly by covering with asbestos fiber cement, slacked lime, wood ashes, or some other material of similar characteristics. Small parts can be covered with asbestos paper, and all drafts avoided.



Correct position for stelliting flat surfaces. The blowpipe is held so that the flame is almost parallel to the surface and the rod extends about 2 in. in the flame

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.30	1.30	1.30	1.30	1.30	1.30
Chaumont, N. Y.	.50	1.75	1.75	1.50	1.50	1.50
Chazy, N. Y.	.75	1.65	1.65	1.40	1.40	1.40
Cobleskill, N. Y.	1.50	1.35	1.25	1.25	1.25	.....
Danbury, Conn.	1.50@2.00	2.00	1.75	1.50	1.35	1.25
Dundas, Ont.	.53	1.05	1.05	.90	.90	.90
Frederick, Md.	.50@ .75	1.20@1.30	1.15@1.25	1.10@1.15	1.10@1.15	1.05@1.10
Munns, N. Y.	1.00	1.40	1.40	1.25	1.25	.....
Northern New Jersey	1.60	1.50@1.80	1.30@2.00	1.40@1.60	1.40@1.60	.....
Prospect, N. Y.	1.00	1.50	1.40	1.30	1.30	.....
Walford, Penn.	.....	.....	1.35h	1.35h	1.35h	1.35h
Watertown, N. Y.	1.00	.....	1.75	1.50	1.50	1.50
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL						
Afton, Mich.	.....	.....	.50	.....	.....	1.50
Alton, Ill.	1.85	.....	1.85	.....	.....	.....
Bloomville, Middlepoint, Dunkirk, Bellevue, Waterville, No. Baltimore, Holland, Kenton, New Paris, Ohio; Monroe, Mich.; Huntington, Bluffton, Ind.	1.00	1.10	1.10	1.00	1.00	1.00
Buffalo and Linwood, Iowa	1.00	.....	1.10	.90	.95	.95
Carey, Ohio	1.05	1.05	1.05	1.05	1.05	1.05
Chasco, Ill.	1.00@1.30	.....	1.00@1.15	.....	1.00@1.15	.....
Columbia and Krause, Ill.	1.00@1.50	.90@1.10	1.20@1.35	1.00@1.20	.90@1.20	.....
			Flux 1.50@1.75			
Greencastle, Ind.	1.30	1.25	1 15	1.05	.95	.95
Lannon, Wis.	.80	1.00	1.00	.90	.90	.90
Linwood, Iowa	1.10	.....	1.30	1.10	1.15	1.15
McCook, Ill.	1.00	1.25	1.25	1.25	1.25	1.25
Milltown, Ind.	.....	90@1.10	.90@1.15	.90@1.00	.85@.90	.85@.90
River Rouge, Mich.	1.20	1.20	1.20	1.20	1.20	1.20
St. Vincent de Paul, Que.	.75	1.20@1.45	.90@1.15	.90@ .95	.85	.85
Sheboygan, Wis.	1.10	1.10	1.10	1.10	1.10	.....
Toledo, Ohio	1.60	1.70	1.70	1.60	1.60	1.60
Toronto, Ont.	1.50	2.00	2.00	1.85	1.85	1.85
Stone City, Iowa	.75	.....	†1.10	1.05	1.00	.....
Waukesha, Wis.	1.10	.....	.90	.90	.90	.90
SOUTHERN:						
Alderson, W. Va.	.50	1.35	1.35	1.25	1.20	1.15
Atlas, Ky.	.....	1.00	1.00	1.00	1.00	1.00
Brooksville, Fla.	.75	.....	2.65	2.65	2.40	2.00
Cartersville, Ga.	1.00	1.50	1.50	1.15	1.15	.....
Chico, Tex.	1.00	1.35	1.25	1.20	1.10	1.00
El Paso, Tex.	1.00	1.00	1.00	1.00	.....	.....
Ft. Springs, W. Va.	.50	1.35	1.35	1.20	1.20	.....
Graystone, Ala.			Crusher run, 1.00 per ton			
Kendrick and Santos, Fla.			3½ in. and less, 1.00 per ton			
New Braunfels, Tex.	.30@1.00	1.00@1.30	1.00@1.30	.70@1.00	.70@ .90	.....
Rocky Point, Va.	.50@1.00	1.40@1.60	1.30@1.40	1.15@1.35	1.10@1.20	1.00@1.05
WESTERN:						
Atchison, Kans.	.25	1.90	1.90	1.90	1.90	1.80
Blue Springs & Wymore, Neb.	.25	1.45	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	1.25	.....	1.25	1.25	1.10	.....
Kansas City, Mo.	1.00	1.50	1.50	1.50	1.50	1.50
Rock Hill, St. Louis Co., Mo.	1.45	1.45	1.45	1.45	1.35	1.35

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.80	1.70	1.45	1.20	1.05	.....
Duluth, Minn.	.90	2.25	1.90	1.50	1.35	1.35
Dwight, Calif.	1.00	.....	1.00	.90	.90	.....
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Texas	2.50	2.00	1.55	1.25	1.15	1.15@1.50
New Haven, New Britain, Meriden & Wallingford, Conn.	.80	1.70	1.45	1.20	1.05	.....
Northern New Jersey	1.40	1.40	1.60	1.40	1.40	.....
Oakland and El Cerito, Cal.	1.00	1.00	1.00	.90	.90	.....
San Diego, Calif.	.....	2.75	2.55	2.35	2.35	.....
Springfield, N. J.	1.75	2.10	2.10	1.70	1.60	1.60
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	.....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley, Montello and Red Granite, Wis.—Granite	1.80	1.70	1.50	1.40	1.40	.....
Coldwater, N. Y.—Dolomite			1.50 all sizes			
Columbia, S. C.	.75	2.00	1.75	1.75	1.60	1.60
Eastern, Penn.—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Penn.—Quartzite	1 20	1 35	1.25	1.20	1.20	1.20
Lithonia, Ga.	.75	2.00b	1.75	1.40	1.40	1.25
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	.....
Middlebrook, Mo.	3.00@3.50	.....	2.00@2.25	2.00@2.25	.....	1.25@3.00
Richmond, Calif.—Quartzite	.75	.....	1.00	1.00	1.00	.....
Somerset, Pa. (sand rock)	1.85@2.00a	.....	1.35@1.50	.....	1.00@1.50	.....
Toccoa, Ga.	.....	1.35	.....	1.30	1.30	1.25

*Cubic yd. †1 in. and less. ‡Two grades. ‖Rip rap per ton. (a) Sand. (b) to ⅛ in. (c) 1 in., 1.40. (d) 2 in., 1.10 (e) Dust. (f) ¼ in. (h) less 10c discount. (i) 1 in., 1.40.

Agricultural Limestone

(Pulverized)

Alderson, W. Va.—50% thru 50 mesh	1.50
Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCo_3$; 90% thru 100 mesh	6.00
Asheville, N. C.—Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; 200-lb. burlap bag, 4.00; bulk	2.75
Atlas, Ky.—90% thru 100 mesh	2.00
50% thru 100 mesh	1.00
Belfast and Rockland, Me. (rail), Lincolnville, Me. (water), analysis $CaCO_3$ 90.04%; $MgCO_3$ 1.5%, 100% thru 14 mesh, bags	4.50
Bulk	3.50
Bettendorf and Moline, Ill.—Analysis, $CaCO_3$, 97%; 2% $MgCO_3$; 50% thru 100 mesh, 1.50; 50% thru 4 mesh	1.50
Blackwater, Mo.—100% thru 4 mesh	1.00
Brandon and Middlebury, Vt.—99% thru 70 mesh, burlap, 5.50; paper, 4.50; bulk	3.50
Branchton and Osborne, Penn.—100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh. (Less 50 cents commission to dealers)	5.00
Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$; pulverized, 50% thru 50 mesh	1.50
Cartersville, Ga.—Pulverized, 2.00; 50% thru 50 mesh	1.50
Chaumont, N. Y.—Pulverized limestone, bags, 4.00; bulk	2.50
Chico, Texas.—50% thru 50 mesh, bulk	1.50
Colton, Calif.—Analysis 90% $CaCO_3$, bulk	4.00
Cypress, Ill.—90% thru 100 mesh	1.35
Ft. Springs, W. Va.—50% thru 4 mesh	1.50
Hillsville, Penn.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$; 75% thru 100 mesh; sacked	5.00
Jamesville, N. Y.—Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.25; bulk	2.75
Joliet, Ill.—90% thru 100-mesh	4.25
Knoxville, Tenn.—80% thru 200 mesh, 3.00; 80% thru 100 mesh, bags, 3.95; bulk	2.70
Marblehead, Ohio—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; 80 lb. paper sacks, 5.00; bulk	3.50
Marion, Va.—Analysis, 90% $CaCO_3$, pulverized, per ton	2.00
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 90% thru 100 mesh	3.90@ 4.50
Milltown, Ind.—Analysis, 94.50% $CaCO_3$, 33% thru 50 mesh, 40% thru 50 mesh; bulk	1.35@ 1.60
Olive Hill, Ky.—50% thru 50 mesh, 2.00; 90% thru 4 mesh	1.00
Piqua, Ohio—Total neutralizing power 95.3%; 99% thru 10, 60% thru 50; 50% thru 100	2.50@ 2.75
100% thru 10, 90% thru 50, 80% thru 100; bags, 5.10; bulk	3.60
99% thru 100, 85% thru 200; bags, 7.00; bulk	5.50
Rocky Point, Va.—Analysis, $CaCO_3$, 95%; $MgCO_3$, 0.75%; 50% thru 100 mesh, burlap bags, 3.50; paper, 3.25; bulk	2.00
Syracuse, N. Y.—Analysis, 89% $CaCO_3$; $MgCO_3$, 4%; bags, 4.25; bulk	2.75
Toledo, Ohio, 30% through 50 mesh	2.25
Waukesha, Wis.—90% thru 100 mesh, 4.50; 50% thru 100 mesh, 2.10; 90% thru 50 mesh	1.65
Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; 50% thru 100 mesh; bags, 4.00; bulk	2.50
West Stockbridge, Mass.—Analysis 90% $CaCO_3$, 50% thru 100 mesh; cloth bags, 4.75; paper, 4.25; bulk	3.25

Agricultural Limestone

(Crushed)

Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 50% thru 4 mesh	3.00
Atlas, Ky.—90% thru 4 mesh	1.00
Bedford, Ind.—Analysis, 98.5% $CaCO_3$, 0.5% $MgCO_3$; 90% thru 10 mesh	1.50
Brandon and Middlebury, Vt.—Pulverized, bags, 5.50; bulk	3.50

(Continued on next page)

Agricultural Limestone

Bridgeport and Chico, Texas—Analysis, 94% $CaCO_3$, 2% $MgCO_3$; 100% thru 10 mesh	1.75
50% thru 4 mesh	1.50
Chicago, Ill.—50% thru 100 mesh; 90% thru 4 mesh	.80
Columbia, Krause, Valmeyer, Ill.—Analysis, 90% $CaCO_3$; 90% thru 4 mesh	1.35
Cypress, Ill.—90% thru 50 mesh, 50% thru 100 mesh, 90% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh	1.35
Danbury, Conn.—Analysis, 81 to 85% $CaCO_3$	3.75@ 4.75
Dundas, Ont.—Analysis, 53.8% $CaCO_3$; $MgCO_3$, 43.3%. 100% thru 10 mesh, 40% thru 50 mesh, 25% thru 100 mesh	1.00
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh	1.50
Kansas City, Mo.—50% thru 100 mesh	1.00
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% through 10 mesh; 46% through 60 mesh	2.00
Screenings (¼ in. to dust)	1.00
Marblehead, Ohio.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$, 32% thru 100 mesh; 51% thru 50 mesh; 83% thru 10 mesh; 100% thru 4 mesh (meal) bulk	1.60
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 50% thru 50 mesh	1.85@ 2.35
McCook, Ill.—90% thru 4 mesh	.90
Middlepoint, Bellevue, Kenton, Ohio; Monroe, Mich.; Huntington and Bluffton, Ind.—Analysis, 42% $CaCO_3$, 54% $MgCO_3$; meal, 25 to 45% thru 100 mesh	1.60
Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh	1.50
Monroe, Mich.—Analysis, $CaCO_3$, 52.03%; 42.25% $MgCO_3$; 30% thru 100 mesh	2.30
Mountville, Va.—Analysis, 62.54% $CaCO_3$; $MgCO_3$, 35.94%, 100% thru 20 mesh; 50% thru 100 mesh bags	5.50
Pixley, Mo.—Analysis, 96% $CaCO_3$; 50% thru 50 mesh	1.25
50% thru 100 mesh; 90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh	1.65
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk	.80@ 1.40
Stone City, Iowa.—Analysis, 98% $CaCO_3$; 50% thru 50 mesh	.75
Tulsa, Okla.—Analysis $CaCO_3$, 86.15%, 1.25% $MgCO_3$, all sizes	1.25

Pulverized Limestone for Coal Operators

Hillsville, Penn., sacks, 4.50; bulk	3.00
Joliet, Ill.—90% thru 100 mesh	3.50
Piqua, Ohio, sacks, 4.50@5.00 bulk	3.00@ 3.50
Rocky Point, Va.—80% thru 200 mesh, bulk	3.00
Waukesha, Wis.—90% thru 100 mesh, bulk	4.50

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Berkeley Springs, W. Va.	2.00@ 2.25
Buffalo, N. Y.	2.00@ 2.50
Cedarville and S. Vineland, N. J.—Damp	1.75
Dry	2.25
Columbus, Ohio	1.00@ 1.50
Estill Springs and Sewanee, Tenn.	1.50
Franklin, Penn.	2.00
Millville, N. J., and Klondike, Mo.	1.75@ 4.25
Los Angeles, Calif.—Washed	5.00
Mapleton Depot, Penn.	2.00@ 2.25
Massillon, Ohio	3.00
Mendota, Va.	2.25@ 2.50
Mineral Ridge and Ohlton, Ohio	2.50
Oceanside, Calif.	3.00
Ottawa Ill.	.75@ 1.25
Pittsburgh, Penn.	3.00@ 4.00
Ridgway, Penn.	2.50
Rockwood, Mich.	2.75@ 3.25
Round Top, Md.	2.00
San Francisco, Calif.	4.00@ 5.00
St. Louis, Mo.	2.00
Sewanee, Tenn.	1.50
Thayers, Penn.	2.50
Utica, Ill.	1.00
Zanesville, Ohio	2.50

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio		1.75
Columbus, Ohio		.30@ 1.50
Dresden, Ohio		1.00
Eau Claire, Wis.	4.25	.65@ 1.25
Estill Springs and Sewanee, Tenn.	1.35@ 1.50	1.35@ 1.50

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in and less
EASTERN:						
Ambridge & So. H'g'ts, Penn.	1.25	1.25	1.15	.85	.85	.85
Attica and Franklinville, N. Y.	.75	.75	.75	.75	.75	.75
Boston, Mass.‡	1.40	1.40			2.25	2.25
Buffalo, N. Y.	1.10	.95			.85	
Erie, Pa.		1.00*		1.50*	1.75*	
Farmingdale, N. J.	.48	.48	.75	1.20	1.10	
Hartford, Conn.	.65*					
Leeds Junction, Me.		.50	1.75		1.35	1.25
Machias Jct., N. Y.		.75	.75		.75	
Montoursville, Penn.		1.00	.75	.75	.75	.75
Northern New Jersey	.40@ .50	.40@ .50	1.25	1.25	1.25	
Olean, N. Y.		.75	.75		.75	
Portland, Me.	1.50	1.50	2.75		2.50	
Shining Point, Penn.			1.00	1.00	1.00	1.00
Somerset, Penn.		1.85@2.00				
South Heights, Penn.	1.25	1.25	.85	.85	.85	.85
Washington, D. C.	.60@ .85	.60@ .85	1.70	1.50	1.30	1.30
CENTRAL:						
Algonquin and Beloit, Wis.	.50	.40	.60	.60	.60	.60
Appleton and Mankato, Minn.		.45	1.25	1.25	1.25	1.25
Attica, Ind.			All sizes .75@.85			
Aurora, Oregon, Sheridan, Moronts, Yorkville, Ill.	.60	.50	.40	.50	.60	.55
Barton, Wis.		.75		.75	.75	.85
Chicago district, Ill.	.70	.55	.55	.60	.60	.60
Columbus, Ohio		.70	.70	.70	.70	
Des Moines, Iowa		.40	1.50			
Eau Claire, Wis.	.65@1.25	.45	.80	.95	.95	
Elgin, Ill.		.20*	.50*	1.50*	1.50*	1.50*
Elkhart Lake, Wisc.	.50	.40	.40	.56	.40	.40
Ferrysburg, Mich.		.50@ .80	.60@1.00	.60@1.00		.50@1.25
Ft. Dodge, Iowa	.85	.85	2.05	2.05	2.05	2.05
Grand Haven, Mich.		.60@ .70		.70@ .90		.70@ .90
Grand Rapids, Mich.		.50		.80	.80	.70
Hamilton, Ohio		1.00			1.00	
Hersey, Mich.		.50				.70
Humboldt, Iowa	.50	.50	1.50	1.50	1.50	1.50
Indianapolis, Ind.	.60	.60		.90	.75@1.00	.75@1.00
Joliet, Plainfield and Hammond, Ill.	.60	.50	.50	.60	.60	.60
Mason City, Iowa	.50	.50	1.45	1.45	1.35	1.35
Mattoon, Ill.	.75	.75	.75	.75	.75	.75
Milwaukee, Wis.		1.01	1.21	1.21	1.21	1.21
Moline, Ill.	.60@ .85	.60@ .85	1.00@1.20	1.00@1.20	1.00@1.20	1.00@1.20
Northern New Jersey	.50	.50	1.50	1.25	1.25	
Pittsburgh, Penn.	1.25	1.25	.85	.85	.85	.85
Silverwood, Ind.	.75	.75	.75	.75	.75	.75
St. Louis, Mo.	.93	1.45	1.55a	1.45	1.45	1.45
Terre Haute, Ind.	.75	.60	.90	.75	.75	.75
Wolcottville, Ind.	.75	.75	.75	.75	.75	.75
Waukesha, Wis.		.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	1.50	1.10	1.10	1.10
Zanesville, Ohio		.60	.50	.60	.80	
SOUTHERN:						
Charleston, W. Va.		All sand, 1.40.		All gravel, 1.50.		
Chattanooga, Tenn.		1.65			1.45	
Chattahoochie River, Fla.		.70		1.75		
Eustis, Fla.		.60@ .70				
Ft. Worth, Texas	2.00	2.00	2.00	2.00	2.00	2.00
Knoxville, Tenn.	1.00	1.00	1.20	1.20	1.20	1.00
Lindsay, Texas					.55	
Macon, Ga.		.50			1.00	
New Martinsville, W. Va.	1.00	.90@1.00		1.20@1.30		.80@ .90
Roseland, La.	.50	.50	1.25	1.00	1.00	1.00
WESTERN:						
Kansas City, Mo.	1.00	.70				
Los Angeles district (bunkers)†	1.50	1.40	1.85	1.85	1.85	1.85
Oregon City, Ore.		1.50*	1.50*	1.50*	1.50*	1.50*
Phoenix, Ariz.	1.25*	1.25*	2.25@2.50*	2.00*	1.75*	1.50*
Pueblo, Colo.	.80	.65		1.35		1.20
San Diego, Calif.	.65@ .75	.65@ .75	1.50	1.30	1.10	1.10
Seattle, Wash. (bunkers)	1.25*	1.25*	1.25*	1.25*	1.25*	1.25*

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Algonquin and Beloit, Wis.			Dust to 3 in., .40			
Burnside, Conn.			Sand, .75*			
Chicago district, Ill.	.35					
Ferrysburg, Mich.						.65@1.00
Gainesville, Texas						.55
Grand Haven, Mich.						.70@ .90
Grand Rapids, Mich.				.60		
Hersey, Mich.				.50		
Indianapolis, Ind.			Mixed gravel for concrete work, at .65			
Joliet, Plainfield and Hammond, Ill.	.35	1.25				
Lindsay, Texas						.55
Macon, Ga.	.40					
Mankato, Minn.			Pit run sand, .70			
Moline, Ill. (b)	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
Ottawa, Oregon, Moronts and Yorkville, Ill.			Ave. .60 per ton all sizes			
Somerset, Penn.		1.85@2.00		1.50@1.75		
St. Louis, Mo.			Mine run gravel, 1.55 per ton			
Shining Point, Penn.			Concrete sand, 1.10 ton			
Summit Grove, Ind.	.50	.50	.50	.50	.50	.54
Winona, Minn.	.60	.60	.60	.60	.60	.60
York, Penn.	1.10	1.00				

(a) ⅝ in. down. (b) River run. (c) 2½ in. and less.
*Cubic yd. †Include freight and bunkerage charges and truck haul. ‡Delivered on job.
(d) Less 10c per ton if paid E.O.M. 10 days. (e) pit run. (f) plus 15c winter loading charge.

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding, brass	Core	Furnace lining	Sand blast	Stone sawing
Aetna, Ill.				.30@ .35			
Albany, N. Y.	2.25	2.00	2.25			3.50	
Arenzville, Ill.	1.50@1.75			1.00			
Beach City, Ohio	1.75@2.00	1.75@2.00		1.75	2.00		1.75
Buffalo, N. Y.	1.50	1.50		2.00@2.50			
Columbus, Ohio	1.25@2.00	1.25@1.75	2.00@2.50	.30@1.50	2.00@2.50	2.75@3.50	1.50@3.00
Dresden, Ohio	1.40	1.50	1.50	1.25	1.50		
Eau Claire, Wis.						3.00	
Elco, Ill.	Ground silica per ton in carloads—18.00@31.00						
Elnora, N. Y.			1.75				
Estill Springs and Sewanee, Tenn.	1.25			1.25		1.35@1.50	
Franklin, Penn.	1.75	1.75	2.00	1.75			
Kasota, Minn.							1.00
Klondike, Mo.	1.75		1.75	1.75	1.75		1.75
Mapleton Depot, Pa.	2.00	2.00		2.00		2.00@2.25	
Massillon, Ohio	2.50	2.50		2.50	2.50		
Mendota, Va.	Ground flint or silex—16.00@20.00 per ton						
Michigan City, Ind.				.20@ .30	.30		
Millville, N. J.				1.75b		3.50	
Montoursville, P'n.				1.25@1.35			
New Lexington, O.	2.00	1.50					
Ohlton, Ohio	1.80b	1.80b		2.00b	1.80b	1.75b	
Ottawa, Ill.	2.50		2.50	1.25	.75	3.50	3.50
Red Wing, Minn.	1.25		1.25	1.50	1.50	3.50	1.50
Ridgeway, Penn.	1.50	1.50					
Round Top, Md.		1.25		1.60		2.25	
San Francisco, Calif.	3.50	4.75	3.50	3.50@5.00	3.50@4.50	3.50@5.00	
Tamalco, Ill.		1.40@1.60					
Tamms, Ill.	Ground silica per ton in carloads—20.00@31.00						
Thayers, Penn.	1.25	1.25		2.00			
Utica, Ill.§	.50@1.00	.50@1.00		.50@1.00	.75@1.00		
Utica, Ill.	.50	.60	1.00	.60	.65	3.00@3.50	1.00@3.50
Utica, Penn.	1.75	1.75		2.00			
Zanesville, Ohio	2.00	1.50	2.00	2.00	2.00		

*Green. †Crude silica, crushed and screened, not washed or dried. ‡Plus 75c per ton for winter loading. ¶Crude. §Crude and dry. (a) Delivered. (b) Damp.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Emporium and Dubois, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Eastern Penn.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Northern, N. J.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
Reading, Pa.	2.50	1.00		1.25			
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	2.05*	1.30*		1.45*	1.45*	1.45*	
Jackson, Ohio		1.05*		1.30*	1.05*	1.30*	
Toledo, Ohio	1.50	1.35	1.35	1.35	1.35	1.35	1.35
Youngst'n, O., dist.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.		1.55*		1.55*	1.55*	1.55*	
Ensley and Alabama City, Ala.	2.05	.80	1.35	1.25	.90	.90	.80
Longdale, Roanoke, Ruessens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
Woodward, Ala.	2.05*	.80*	1.35*	1.25*	.90*	.90*	

*5c per ton discount on terms.

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.			12.00					2.15e
Buffalo, N. Y.		12.00	12.00	12.00			10.00	1.95d
Chazy, N. Y.	12.50	10.50	8.00	12.00	11.50	16.50	10.00	2.50₂
Lime Ridge, Penn.					5.00a			
West Stockbridge, Mass.	12.00	10.00	5.60					2.00t
Williamsport, Penn.			10.00				6.00	
York, Penn.		9.50	9.50	10.50	8.50	10.50	8.50	1.65i
CENTRAL:								
Carey, Ohio	12.50	8.50	8.00		9.00		8.50	2.00
Cold Springs, Ohio	12.50	8.50	8.50		9.00		8.00	
Delaware, Ohio		8.50	8.50	10.00			8.50	1.50
Frederick, Md.		10.00	10.00	10.00	8.50	10.00	7.00	
Gibsonburg, Ohio	12.50	8.50	8.50		9.00	11.00	8.50	
Huntington, Ind.	12.50	8.50	8.50		9.00		8.00	
Luckey, Ohio	12.50							
Marblehead, Ohio		8.50	8.50		9.00		8.00	1.50w
Marion, Ohio		8.50	.850				8.00	1.70d
Milltown, Ind.		9.00@10.00		10.00p			8.50q	1.40r
Sheboygan, Wis.	11.50						9.50	.95
Tiffin, Ohio					9.00			
White Rock, Ohio	12.50				9.00	11.00	8.00	
Wisconsin points (f)		11.50					9.50	
Woodville, Ohio	12.50	8.50	8.50	13.50	9.00	11.00	9.00	1.50c
SOUTHERN:								
Allgood, Ala.	12.50	10.00			8.50		8.50	1.50
El Paso, Tex.	22.50						8.00	
Graystone, Ala.	12.50	10.00		12.50			8.50	1.50
Keystone, Ala.		10.00	10.00	10.00	8.50	1.45u	8.50	1.50
Knoxville, Tenn.	20.25	10.00	10.00	10.00			8.50	1.50
Longview, Ala.	12.50	10.00	9.00	10.00			8.50	1.50
Ocala, Fla.	14.00	13.00	12.00	13.00			12.00	1.70
Saginaw, Ala.	12.50	10.00	9.00	10.00			8.50	1.50
WESTERN:								
Kirtland, N. M.							15.00	
Limestone, Wash.	15.00	15.00	10.00	15.00	16.50	16.50	16.50	2.09
Dittlinger, Tex.		12.00@13.00					9.50p	1.50₄
San Francisco, Calif.	21.00	19.00	16.50				14.00	2.00
Tehachapi, Calif.			8.00				13.00z	2.20x
Seattle, Wash.	19.00	19.00	12.00	19.00	19.00		18.60	2.30

†50-lb. paper bags; (a) run of kilns; (c) wooden, steel 1.70; (d) steel; (e) per 180-lb. barrel; (f) dealers' prices, net 30 days less 25c disc. per ton on hydrated lime and 5c per bbl. on lump if paid in 10 days; (i) 180-lb. net barrel, 1.65; 280-lb. net barrel, 2.65; (p) to 11.00; (q) to 8.75; (r) to 1.50; (s) in 80-lb. burlap sacks; (t) to 3.00; (u) two 90-lb. bags; (v) oil burnt; wood burnt 2.25@2.50; (x) wood, steel 2.30; (z) to 15.00; (*) quoted f.o.b. New York; (‡) paper bags; (w) to 1.50 in two 90-lb. bags, wood bbl. 1.60; (¶) to 10.00; (1) 80-lb. paper bags; (2) to 3.00; (3) to 9.00; (4) to 1.60. (8) to 16.00; (e) wood bbl., steel, 1.80.

Miscellaneous Sands

(Continued)

City or shipping point	Roofing sand	Traction
Gray Summit and Klondike, Mo.		1.75
Mapleton Depot, Penn.	2.00	2.00
Massillon, Ohio		2.25
Michigan City, Ind. (Engine sand)		.15@ .25
Mineral Ridge, Ohio	*1.75@ 2.00	*1.75
Montoursville, Penn.		1.25
Ohlton, Ohio	1.80	1.80
Ottawa, Ill.	1.25	
Red Wing, Minn.		1.25
Round Top, Md.	2.25	1.75
San Francisco, Calif.	3.50@ 4.50	3.50@ 4.50
Thayers, Penn.		2.25
Utica, Ill.	1.00@ 3.50	1.00
Warwick, Ohio		2.25
Zanesville, Ohio		2.50

*Wet.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Baltimore, Md.:	
Crude talc (mine run)	3.00@ 4.00
Ground talc (20-50 mesh), bags	10.00
Cubes	55.00
Blanks (per lb.)	.08
Pencils and steel worker's crayons	.08
per gross	1.00@ 1.50
Chatsworth, Ga.:	
Crude Talc	5.00
Ground (150-200 mesh), bulk	10.00
Pencils and steel worker's crayons, per gross	1.00@ 2.00
Chester, Vt.:	
Ground talc (150-200 mesh), bulk	9.00@10.00
Including bags	10.00@11.00
Chicago and Joliet, Ill.:	
Ground (150-200 mesh), bags	30.00
Dalton, Ga.:	
Crude talc	5.00
Ground talc (150-200) bags	10.00@12.00
Pencils and steel workers' crayons, per gross	1.00@ 1.50
Emeryville, N. Y.:	
(Double air floated) including bags;	
325 mesh	14.75
200 mesh	13.75
Hailesboro, N. Y.:	
Ground white talc (double and triple air floated) including bags, 300-350 mesh	15.50@20.00
Henry, Va.:	
Crude (mine run)	3.50@ 4.50
Ground talc (150-200 mesh), bulk	9.00@14.50
Joliet, Ill.:	
Roofing talc, bags	12.00
Ground talc (200 mesh), bags	30.00
Keeler, Calif.:	
Ground (200-300 mesh), bags	20.00@30.00
Natural Bridge, N. Y.:	
Ground talc (125-200 mesh), bags	10.00@15.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 65-70%	4.00@ 5.00
Mt. Pleasant, Tenn.—B.P.L. 75%	5.50@ 6.00
Tennessee—F.O.B. mines, gross ton, unground brown rock, B.P.L. 72%	5.00
B.P.L. 75%	6.00
Twomey, Tenn.—B.P.L. 65%, 2000 lb.	8.00@ 9.00

Ground Rock

(2000 lbs.)

Centerville, Tenn.—B.P.L. 65%	7.00
Gordonsburg, Tenn.—B.P.L. 65-72%	4.00@ 4.50
Mt. Pleasant, Tenn.—B.P.L. 65%	8.00@10.00
Twomey, Tenn.—B.P.L. 65%	8.00

Florida Phosphate

(Raw Land Pebble)

(Per Ton.)

Florida—F. O. B. mines, gross ton, 68/66% B.P.L., Basis 68%	3.25
70% min. B.P.L., Basis 70%	3.75

Mica

Prices given are net, F.O.B. plant or nearest shipping point.

Franklin, N. C.—Mine run, per lb.	.05@.10
Mine scrap, per ton	20.00
Clean shop scrap, per ton	22.00
Punch mica, per lb.	.05@.10
Pringle, S. D.—Mine run, per ton	125.00
Punch mica, per lb.	.06
Scrap, per ton, carloads	20.00
Rumney Depot, N. H. — per ton,	
Mine run	360.00
Clean shop scrap	25.00
Roofing mica	37.50
40 mesh	40.00
60 mesh	45.00
200 mesh	65.00
Punch mica, per lb.	.10

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Barton, Wis., f.o.b. cars		10.50
Brandon, Vt.—English pink and English cream	*11.00	*11.00
Brandon grey	*11.00	*11.00
Brighton, Tenn.—Pink	6.00	5.00
Mixed pink and bronze	4.50@ 6.00	4.50@ 6.00
All colors, mixed sizes	3.50	3.50
Buckingham, Que.—Buff stucco dash		12.00@14.00
Chicago, Ill. — Stucco chips, in sacks f.o.b. quarries		17.50
Crown Point, N. Y.—Mica Spar		9.00@10.00
Dayton, Ohio		6.00@24.00
Easton, Penn., and Phillipsburg, N. J.	12.00@16.00	12.00@16.00
Haddam, Conn. — Felstone buff	15.00	15.00
Harrisonburg, Va.—Bulk marble (crushed, in bags)	†12.50	†12.50
Ingomar, Ohio — Concrete facings and stucco dash		6.00@20.00
Middlebrook, Mo.—Red		25.00@30.00
Middlebury, Vt.—Middlebury white		†9.00
Marble flour, 100% thru 80 mesh		3.50
Crusher run marble		3.50
Milwaukee, Wis.		14.00@34.00
Newark, N. J.—Roofing granules		7.50
New York, N. Y.—Red and yellow Verona		32.00
Red Granite, Wis.		7.50
Stockton, Calif. — "Natrock" roofing grits		12.00@15.00
Tuckahoe, N. Y.—Tuckahoe white	12.00	12.00
Wauwatosa, Wis.		20.00@32.00
Wellsville, Colo.—Colorado Travertine Stone	15.00	15.00

†C.L. L.C.L. 17.00.
*C.L. including bags; L.C.L. 14.50
‡C.L. including bags, L.C.L. 10.00.

Potash Feldspar

Auburn and Brunswick, Me.—Color, white; 98% thru 140 mesh bulk	19.00
Buckingham, Que.—Color, white; analysis, K_2O, 12-13%; Na_2O, 1.75%; bulk	9.00
De Kalb Jct., N. Y.—Color, white; bulk (crude)	9.00
East Hartford, Conn.—Color, white, 95% through 60 mesh, bags	16.00
96% thru 150 mesh, bags	23.00
East Liverpool, Ohio—Color, white; 98% thru 200 mesh, bulk	19.35
Soda feldspar, crude, bulk, per ton	22.00
Erwin, Tenn.—Color, white; analysis, 12.07% K_2O, 19.34% Al_2O_3; Na_2O, 2.92%; SiO_2, 64.76%; Fe_2O_3, .36%; 98.50% thru 200 mesh, bags, 16.90; bulk	15.50
Glen Tay Station, Ont., color, red or punk; analysis: K_2O, 12.81%, crude (bulk)	7.00
Keystone, S. D.—Prime white, bulk (crude)	8.00
Los Angeles, Calif.—Color, white; analysis, K_2O, 10.35%; Na_2O, 3.62%; Al_2O_3, 18.71%; SiO_2, 65.48%; Fe_2O_3, .17%; 95% thru 200 mesh, bags included, carloads	22.00
Bulk	20.00
Murphsboro, Ill.—Color, snow white; analysis SiO_2, 64.4%; K_2O, 13%; Na_2O, 2.5%; Fe_2O_3, 0.07%; Al_2O_3, 19.3%; 99% thru 200 mesh, bags	21.00
Bulk	20.00
Penland, N. C.—Color, white; crude, bulk	8.00
Ground, bulk	16.50
Tenn. Mills—Color, white; analysis K_2O, 18%; Na_2O_3, 10%; 65% SiO_2; 99% thru 200 mesh; bulk	18.00
99% thru 140 mesh, bulk	16.00
Toughkenamon, Penn.—Color, cream; 90% thru 200 mesh, bags 14.00, bulk	10.00
Toronto, Can.—Color, flesh; analysis K_2O, 12.75%; Na_2O, 1.96%; crude	7.50@ 8.00
Trenton, N. J.—Crude, bulk	12.00@27.00
99% thru 140 mesh; bulk	16.00

(Bags 11 cents each, non-returnable)

Blended Feldspar

(Pulverized)

Tenn. Mills—Bulk 16.00@20.00

Chicken Grits

Afton Mich. (limestone) per ton	10.00
Belfast and Rockland, Me.—(Limestone), bags, per ton	‡10.00
Brandon and Middlebury, Vt., per ton	5.50@10.00
Centerville, Iowa (gypsum) per ton	18.00
Chico, Texas (limestone), 100 lb. bags, per ton	8.00@ 9.00
Danbury, Conn. (limestone)	7.00@ 9.00
Easton, Penn.—Per ton, bulk	3.00
Knoxville, Tenn. (limestone), bags, per ton 7.00; bulk	5.00
Los Angeles Harbor (limestone), 100-lb sack, 1.00; sacks, per ton, 8.50@ 9.50†; bulk, per ton	6.00@7.00†
Gypsum, Ohio.—(Gypsum) per ton	10.00
Limestone, Wash. (limestone) per ton	12.50
Rocky Point, Va. (limestone) 100 lb. bags, 75c; sacks, per ton, 6.00 bulk	5.00
Seattle, Wash.—(Limestone), bulk, per ton	12.50
Warren, N. H.—(Mica) per ton	7.70@7.90‡
Waukesha, Wis.—(Limestone), per ton	8.00
West Stockbridge, Mass.—(Limestone) bulk	7.50@9.60*

*L.C.L.
†Less than 5-ton lots.
‡C.L.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	10.50
Boston, Mass.	*17.00
Brighton, N. Y.	*19.75
Dayton, Ohio	12.00@13.50
Detroit, Mich.	15.00@*17.50
Farmington, Conn.	13.00
Flint, Mich.	¶12.50@16.00
Grand Rapids, Mich.	12.00
Hartford, Conn.	*19.00
Jackson, Mich.	12.25
Lancaster, N. Y.	12.50
Madison, Wis.	a12.00
Michigan City, Ind.	11.00
Milwaukee, Wis.	*13.00
Minneapolis and St. Paul, Minn.	11.25
Minnesota Transfer	10.00
New Brighton, Minn.	10.00
Pontiac, Mich.	12.00@13.50
Portage, Wis.	15.00
Prairie du Chien, Wis.	18.00@22.50
Rochester, N. Y.	*19.75
Saginaw, Mich.	13.00
San Antonio, Texas	14.00
Sebewaing, Mich.	12.00
Syracuse, N. Y.	18.00@20.00*
Toronto, Canada	13.00@15.60†
Toronto, Canada	13.10
Wilkinson, Fla.	10.00@12.00

*Delivered on job. †Sales tax included.
‡Less 5%. ¶Dealers' price. (a) Less 1.00 E.O. M. 10 days.

Portland Cement

Prices per bag and per bbl, without bags net in carload lots.

	Per Bag	Per Bbl.
Albuquerque, N. M.		3.47
Atlanta, Ga.		2.35
Baltimore, Md.		2.15
Birmingham, Ala.		2.30
Boston, Mass.		2.43
Buffalo, N. Y.		2.28
Butte, Mont.	.90¼	3.61
Cedar Rapids, Iowa		2.34‡
Charleston, S. C.		2.35
Cheyenne, Wyo.	.82¾	3.31
Cincinnati, Ohio	56¼	2.37‡
Cleveland, Ohio		2.29‡
Chicago, Ill.		2.10‡
Columbus, Ohio		2.24
Dallas, Texas		2.10
Davenport, Iowa		2.29‡
Dayton, Ohio	.57	2.28
Denver, Colo.	.66¼	2.65
Detroit, Mich.		1.95
Duluth, Minn.		2.09‡
Houston, Texas		2.60
Indianapolis, Ind.		2.19
Jackson, Miss.		2.50
Jacksonville, Fla.		2.20
Jersey City, N. J.		2.13
Kansas City, Mo.		1.92
Los Angeles, Calif.	.61†	2.44†
Louisville, Ky.	.54¼	
Memphis, Tenn.		2.60
Milwaukee, Wis.		2.25‡
Minneapolis, Minn.		2.32‡
Montreal, Que.		1.36
New Orleans, La.		2.20
New York, N. Y.		2.05
Norfolk, Va.		2.07
Oklahoma City, Okla.		2.46
Omaha, Neb.		2.36
Peoria, Ill.		2.27‡
Philadelphia, Penn.		2.21
Phoenix, Ariz.		2.91
Pittsburgh, Penn.		2.09‡
Portland, Colo.		2.80
Portland, Ore.		2.60
Reno, Nevada		2.91
Richmond, Va.		2.34
Salt Lake City, Utah	.70¼	2.81
San Francisco, Cal.		2.31
Savannah, Ga.		2.50
St. Louis, Mo.	.55	2.20
St. Paul, Minn.		2.32‡
Seattle, Wash.	10c discount	2.50
Tampa, Fla.		2.25
Toledo, Ohio		2.20‡
Topeka, Kans.		2.41
Tulsa, Okla.		2.33
Wheeling, W. Va.		2.07
Winston-Salem, N. C.		2.78

NOTE—Add 40c per bbl. for bags.
†Delivered on job in any quantity, sacks extra.
‡Ten cents discount for cash, 15 days.

Mill prices f.o.b. in carload lots, without bags, to contractors.

	Per Bag	Per Bbl.
Buffington, Ind.		1.85
Chattanooga, Tenn.		2.45*
Concrete, Wash.		2.35
Davenport, Calif.		2.05
Detroit, Mich.		2.15
Hannibal, Mo.		1.85
Hudson, N. Y.		1.95
Leeds, Ala.		1.95
Mildred, Kans.		2.35
Nazareth, Penn.		1.95
Northampton, Penn.		1.85
Richard City, Tenn.		2.05
Steelton, Minn.		1.90
Toledo, Ohio		2.20
Universal, Penn.		1.85

*Including sacks at 10c each.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	White Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	—Plaster Board— ⅜x32x 36", Wt. 1500 lb. Per M Sq. Ft.	⅜x32x 36", Wt. 1850 lb. Per M Sq. Ft.	Wallboard, ⅜x32 or 48", Lgths. 6'-10', 1850 lb. Per M Sq. Ft.
Arden, Nev. and Los Angeles, Calif.	3.00	8.00u	8.00u	10.70u	10.70u					11.70u			
Centerville, Iowa	3.00	10.00	15.00	10.00	10.00	10.50	13.50			13.50			
Detroit, Mich.								m9.00@11.00o					
Delawanna, N. J.						8.00	8.25@9.40				.14½s	.15½s	40.00@41.00
Douglas, Ariz.			7.00			15.50d	18.50		30.00	15.50			
Grand Rapids, Mich.	2.75	6.00	6.00	8.00	9.00	9.00	17.50		24.55	20.00			
Gypsum, Ohio‡	3.00	4.00	6.00	8.00	9.00	9.00	19.00	7.00	27.00	20.00		15.00	30.00
Los Angeles, Calif.			10.40k	11.10k									
Port Clinton, Ohio	3.00	4.00	6.00	10.00	9.00	9.00	21.00	7.00	30.15	20.00		20.00	30.00
Portland, Colo.				10.00									
San Francisco, Cal.			14.00	14.40	15.40		15.40						
Seattle, Wash.	6.60	11.00	11.00	15.00		16.00							
Sigurd, Utah									21.50				
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00					20.00	25.00	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable).
*To 3.00; †to 11.00; ¶to 12.00; ‡prices per net ton, sacks extra; (a) to 25.00; (b) net; (c) gross; (d) hair fibre; (g) delivered; (h) delivered in six states; (i) delivered on job; (k) sacks 12c extra, rebated; (m) includes paper bags; (o) includes jute sacks; (r) including sacks at 15c; (s) per board; (t) to 16.50; (u) includes sacks; (v) F.O.B. N. Y. C. and dealers yard in mill locality.

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding, brass	Core	Furnace lining	Sand blast	Stone sawing
Aetna, Ill.				.30@ .35			
Albany, N. Y.	2.25	2.00	2.25			3.50	
Arenzville, Ill.	1.50@1.75			1.00			
Beach City, Ohio	1.75@2.00	1.75@2.00		1.75	2.00		1.75
Buffalo, N. Y.	1.50	1.50		2.00@2.50			
Columbus, Ohio	1.25@2.00	1.25@1.75	2.00@2.50	.30@1.50	2.00@2.50	2.75@3.50	1.50@3.00
Dresden, Ohio	1.40	1.50	1.50	1.25	1.50		
Eau Claire, Wis.						3.00	
Elco, Ill.	Ground silica per ton in carloads—18.00@31.00						
Elnora, N. Y.			1.75				
Estill Springs and Sewanee, Tenn.	1.25			1.25		1.35@1.50	
Franklin, Penn.	1.75	1.75	2.00	1.75			
Kasota, Minn.							1.00
Klondike, Mo.	1.75		1.75	1.75	1.75		1.75
Mapleton Depot, Pa.	2.00	2.00		2.00		2.00@2.25	
Massillon, Ohio	2.50	2.50		2.50	2.50		
Mendota, Va.	Ground flint or silex—16.00@20.00 per ton						
Michigan City, Ind.				.20@ .30	.30		
Millville, N. J.				1.75b		3.50	
Montoursville, P'n.				1.25@1.35			
New Lexington, O.	2.00	1.50					
Ohlton, Ohio	1.80b	1.80b		2.00b	1.80b	1.75b	
Ottawa, Ill.	2.50		2.50	1.25	.75	3.50	3.50
Red Wing, Minn.	1.25		1.25	1.50	1.50	3.50	1.50
Ridgeway, Penn.	1.50	1.50					
Round Top, Md.		1.25		1.60		2.25	
San Francisco, Calif.	3.50	4.75	3.50	3.50@5.00	3.50@4.50	3.50@5.00	
Tamalco, Ill.		1.40@1.60					
Tamms, Ill.	Ground silica per ton in carloads—20.00@31.00						
Thayers, Penn.	1.25	1.25		2.00			
Utica, Ill.§	.50@1.00	.50@1.00		.50@1.00	.75@1.00		
Utica, Ill.	.50	.60	1.00	.60	.65	3.00@3.50	1.00@3.50
Utica, Penn.	1.75	1.75		2.00			
Zanesville, Ohio	2.00	1.50	2.00	2.00	2.00		

*Green. †Crude silica, crushed and screened, not washed or dried. ‡Plus 75c per ton for winter loading. ¶Crude. §Crude and dry. (a) Delivered. (b) Damp.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Emporium and Dubois, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Eastern Penn.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Northern, N. J.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
Reading, Pa.	2.50	1.00		1.25			
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	2.05*	1.30*		1.45*	1.45*	1.45*	
Jackson, Ohio		1.05*		1.30*	1.05*	1.30*	
Toledo, Ohio	1.50	1.35	1.35	1.35	1.35	1.35	1.35
Youngst'n, O., dist.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.		1.55*		1.55*	1.55*	1.55*	
Ensley and Alabama City, Ala.	2.05	.80	1.35	1.25	.90	.90	.80
Longdale, Roanoke,							
Ruessens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
Woodward, Ala.	2.05*	.80*	1.35*	1.25*	.90*	.90*	

*5c per ton discount on terms.

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.			12.00					2.15e
Buffalo, N. Y.		12.00	12.00	12.00			10.00	1.95d
Chazy, N. Y.	12.50	10.50	8.00	12.00	11.50	16.50	10.00	2.50₂
Lime Ridge, Penn.					5.00a			
West Stockbridge, Mass.	12.00	10.00	5.60					2.00t
Williamsport, Penn.			10.00				6.00	
York, Penn.		9.50	9.50	10.50	8.50	10.50	8.50	1.65i
CENTRAL:								
Carey, Ohio	12.50	8.50	8.00		9.00		8.50	2.00
Cold Springs, Ohio	12.50	8.50	8.50		9.00		8.00	
Delaware, Ohio		8.50	8.50	10.00			8.50	1.50
Frederick, Md.		10.00	10.00	10.00	8.50	10.00	7.00	
Gibsonburg, Ohio	12.50	8.50	8.50		9.00	11.00	8.50	
Huntington, Ind.	12.50	8.50	8.50		9.00		8.00	
Luckey, Ohio	12.50							
Marblehead, Ohio		8.50	8.50		9.00		8.00	1.50w
Marion, Ohio		8.50	.850				8.00	1.70d
Milltown, Ind.		9.00@10.00		10.00p			8.50q	1.40r
Sheboygan, Wis.	11.50						9.50	.95
Tiffin, Ohio					9.00			
White Rock, Ohio	12.50				9.00	11.00	8.00	
Wisconsin points (f)		11.50					9.50	
Woodville, Ohio	12.50	8.50	8.50	13.50	9.00	11.00	9.00	1.50c
SOUTHERN:								
Allgood, Ala.	12.50	10.00			8.50		8.50	1.50
El Paso, Tex.	22.50						8.00	
Graystone, Ala.	12.50	10.00		12.50			8.50	1.50
Keystone, Ala.		10.00	10.00	10.00	8.50	1.45u	8.50	1.50
Knoxville, Tenn.	20.25	10.00	10.00	10.00			8.50	1.50
Longview, Ala.	12.50	10.00	9.00	10.00			8.50	1.50
Ocala, Fla.	14.00	13.00	12.00	13.00			12.00	1.70
Saginaw, Ala.	12.50	10.00	9.00	10.00			8.50	1.50
WESTERN:								
Kirtland, N. M.							15.00	
Limestone, Wash.	15.00	15.00	10.00	15.00	16.50	16.50	16.50	2.09
Dittlinger, Tex.		12.00@13.00					9.50p	1.50₄
San Francisco, Calif.	21.00	19.00	16.50				14.00	2.00
Tehachapi, Calif.			8.00				13.00z	2.20x
Seattle, Wash.	19.00	19.00	12.00	19.00	19.00		18.60	2.30

†50-lb. paper bags; (a) run of kilns; (c) wooden, steel 1.70; (d) steel; (e) per 180-lb. barrel; (f) dealers' prices, net 30 days less 25c disc. per ton on hydrated lime and 5c per bbl. on lump if paid in 10 days; (i) 180-lb. net barrel, 1.65; 280-lb. net barrel, 2.65; (p) to 11.00; (q) to 8.75; (r) to 1.50; (s) in 80-lb. burlap sacks; (t) to 3.00; (u) two 90-lb. bags; (v) oil burnt; wood burnt 2.25@2.50; (x) wood, steel 2.30; (z) to 15.00; (*) quoted f.o.b. New York; (‡) paper bags; (w) to 1.50 in two 90-lb. bags, wood bbl. 1.60; (1) to 10.00; (3) 80-lb. paper bags; (2) to 3.00; (3) to 9.00; (4) to 1.60. (5) to 16.00; (6) wood bbl., steel, 1.80.

Miscellaneous Sands

(Continued)

City or shipping point	Roofing sand	Traction
Gray Summit and Klondike, Mo.		1.75
Mapleton Depot, Penn.	2.00	2.00
Massillon, Ohio		2.25
Michigan City, Ind. (Engine sand)		.15@ .25
Mineral Ridge, Ohio	*1.75@ 2.00	*1.75
Montoursville, Penn.		1.25
Ohlton, Ohio	1.80	1.80
Ottawa, Ill.	1.25	
Red Wing, Minn.		1.25
Round Top, Md.	2.25	1.75
San Francisco, Calif.	3.50@ 4.50	3.50@ 4.50
Thayers, Penn.		2.25
Utica, Ill.	1.00@ 3.50	1.00
Warwick, Ohio		2.25
Zanesville, Ohio		2.50

*Wet.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point,

Baltimore, Md.:
- Crude talc (mine run) 3.00@ 4.00
- Ground talc (20-50 mesh), bags 10.00
- Cubes 55.00
- Blanks (per lb.) .08
- Pencils and steel worker's crayons, per gross .08
- 1.00@ 1.50

Chatsworth, Ga.:
- Crude Talc 5.00
- Ground (150-200 mesh), bulk 10.00
- Pencils and steel worker's crayons, per gross 1.00@ 2.00

Chester, Vt.:
- Ground talc (150-200 mesh), bulk 9.00@10.00
- Including bags 10.00@11.00

Chicago and Joliet, Ill.:
- Ground (150-200 mesh), bags 30.00

Dalton, Ga.:
- Crude talc 5.00
- Ground talc (150-200) bags 10.00@12.00
- Pencils and steel workers' crayons, per gross 1.00@ 1.50

Emeryville, N. Y.:
- (Double air floated) including bags;
- 325 mesh 14.75
- 200 mesh 13.75

Hailesboro, N. Y.:
- Ground white talc (double and triple air floated) including bags, 300-350 mesh 15.50@20.00

Henry, Va.:
- Crude (mine run) 3.50@ 4.50
- Ground talc (150-200 mesh), bulk 9.00@14.50

Joliet, Ill.:
- Roofing talc, bags 12.00
- Ground talc (200 mesh), bags 30.00

Keeler, Calif.:
- Ground (200-300 mesh), bags 20.00@30.00

Natural Bridge, N. Y.:
- Ground talc (125-200 mesh), bags 10.00@15.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 65-70% 4.00@ 5.00
Mt. Pleasant, Tenn.—B.P.L. 75% 5.50@ 6.00
Tennessee—F.O.B. mines, gross ton, unground brown rock, B.P.L. 72% 5.00
B.P.L. 75% 6.00
Twomey, Tenn.—B.P.L. 65%, 2000 lb. 8.00@ 9.00

Ground Rock

(2000 lbs.)

Centerville, Tenn.—B.P.L. 65% 7.00
Gordonsburg, Tenn.—B.P.L. 65-72% 4.00@ 4.50
Mt. Pleasant, Tenn.—B.P.L. 65% 8.00@10.00
Twomey, Tenn.—B.P.L. 65% 8.00

Florida Phosphate

(Raw Land Pebble)

(Per Ton.)

Florida—F. O. B. mines, gross ton,
- 68/66% B.P.L., Basis 68% 3.25
- 70% min. B.P.L., Basis 70% 3.75

Mica

Prices given are net, F.O.B. plant or nearest shipping point.

Franklin, N. C.—Mine run, per lb. .05@.10
- Mine scrap, per ton 20.00
- Clean shop scrap, per ton 22.00
- Punch mica, per lb. .05@.10

Pringle, S. D.—Mine run, per ton 125.00
- Punch mica, per lb. .06
- Scrap, per ton, carloads 20.00

Rumney Depot, N. H. — per ton,
- Mine run 360.00
- Clean shop scrap 25.00
- Roofing mica 37.50
- 40 mesh 40.00
- 60 mesh 45.00
- 200 mesh 65.00

Punch mica, per lb. .10

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Barton, Wis., f.o.b. cars	.....	10.50
Brandon, Vt.—English pink and English cream	*11.00	*11.00
Brandon grey	*11.00	*11.00
Brighton, Tenn.—Pink..	6.00	5.00
Mixed pink and bronze	4.50@ 6.00	4.50@ 6.00
All colors, mixed sizes	3.50	3.50
Buckingham, Que.—Buff stucco dash	.....	12.00@14.00
Chicago, Ill. — Stucco chips, in sacks f.o.b. quarries	.....	17.50
Crown Point, N. Y.—Mica Spar	.....	9.00@10.00
Dayton, Ohio	.....	6.00@24.00
Easton, Penn., and Phillipsburg, N. J.	12.00@16.00	12.00@16.00
Haddam, Conn. — Felstone buff	15.00	15.00
Harrisonburg, Va.—Bulk marble (crushed, in bags)	†12.50	†12.50
Ingomar, Ohio — Concrete facings and stucco dash	.....	6.00@20.00
Middlebrook, Mo.—Red	.....	25.00@30.00
Middlebury, Vt.—Middlebury white	.....	†9.00
Marble flour, 100% thru 80 mesh	.....	3.50
Crusher run marble	.....	3.50
Milwaukee, Wis.	.....	14.00@34.00
Newark, N. J.—Roofing granules	.....	7.50
New York, N. Y.—Red and yellow Verona	.....	32.00
Red Granite, Wis.	.....	7.50
Stockton, Calif. — "Natrock" roofing grits	.....	12.00@15.00
Tuckahoe, N. Y.—Tuckahoe white	12.00	12.00
Wauwatosa, Wis.	.....	20.00@32.00
Wellsville, Colo.—Colorado Travertine Stone	15.00	15.00

†C.L. L.C.L. 17.00.
*C.L. including bags; L.C.L. 14.50
‡C.L. including bags, L.C.L. 10.00.

Potash Feldspar

Auburn and Brunswick, Me.—Color, white; 98% thru 140 mesh bulk	19.00
Buckingham, Que.—Color, white; analysis, K_2O, 12-13%; Na_2O, 1.75%; bulk	9.00
De Kalb Jct., N. Y.—Color, white; bulk (crude)	9.00
East Hartford, Conn.—Color, white, 95% through 60 mesh, bags	16.00
96% thru 150 mesh, bags	23.00
East Liverpool, Ohio—Color, white; 98% thru 200 mesh, bulk	19.35
Soda feldspar, crude, bulk, per ton	22.00
Erwin, Tenn.—Color, white; analysis, 12.07% K_2O, 19.34% Al_2O_3; Na_2O, 2.92%; SiO_2, 64.76%; Fe_2O_3, .36%; 98.50% thru 200 mesh, bags, 16.90; bulk	15.50
Glen Tay Station, Ont., color, red or punk; analysis: K_2O, 12.81%, crude (bulk)	7.00
Keystone, S. D.—Prime white, bulk (crude)	8.00
Los Angeles, Calif.—Color, white; analysis, K_2O, 10.35%; Na_2O, 3.62%; Al_2O_3, 18.71%; SiO_2, 65.48%; Fe_2O_3, .17%; 95% thru 200 mesh, bags included, carloads	22.00
Bulk	20.00
Murphsboro, Ill.—Color, snow white; analysis SiO_2, 64.4%; K_2O, 13%; Na_2O, 2.5%; Fe_2O_3, 0.07%; Al_2O_3, 19.3%; 99% thru 200 mesh, bags	21.00
Bulk	20.00
Penland, N. C.—Color, white; crude, bulk	8.00
Ground, bulk	16.50
Tenn. Mills—Color, white; analysis K_2O, 18%; Na_2O_3, 10%; 68% SiO_2; 99% thru 200 mesh; bulk	18.00
99% thru 140 mesh, bulk	16.00
Toughkenamon, Penn.—Color, cream; 90% thru 200 mesh, bags 14.00, bulk	10.00
Toronto, Can.—Color, flesh; analysis K_2O, 12.75%; Na_2O, 1.96%; crude	7.50@ 8.00
Trenton, N. J.—Crude, bulk	12.00@27.00
99% thru 140 mesh; bulk	16.00

(Bags 11 cents each, non-returnable)

Blended Feldspar

(Pulverized)

Tenn. Mills—Bulk ..... 16.00@20.00

Chicken Grits

Afton Mich. (limestone) per ton	10.00
Belfast and Rockland, Me.—(Limestone), bags, per ton	‡10.00
Brandon and Middlebury, Vt., per ton	5.50@10.00
Centerville, Iowa (gypsum) per ton	18.00
Chico, Texas (limestone), 100 lb. bags, per ton	8.00@ 9.00
Danbury, Conn. (limestone)	7.00@ 9.00
Easton, Penn.—Per ton, bulk	3.00
Knoxville, Tenn. (limestone), bags, per ton 7.00; bulk	5.00
Los Angeles Harbor (limestone), 100-lb sack, 1.00; sacks, per ton, 8.50@ 9.50†; bulk, per ton	6.00@7.00†
Gypsum, Ohio.—(Gypsum) per ton	10.00
Limestone, Wash. (limestone) per ton	12.50
Rocky Point, Va. (limestone) 100 lb. bags, 75c; sacks, per ton, 6.00 bulk	5.00
Seattle, Wash.—(Limestone), bulk, per ton	12.50
Warren, N. H.—(Mica) per ton	7.70@7.90‡
Waukesha, Wis.—(Limestone), per ton	8.00
West Stockbridge, Mass.—(Limestone) bulk	7.50@9.80*

*L.C.L.
†Less than 5-ton lots.
‡C.L.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	10.50
Boston, Mass.	*17.00
Brighton, N. Y.	*19.75
Dayton, Ohio	12.00@13.50
Detroit, Mich.	15.00@*17.50
Farmington, Conn.	13.00
Flint, Mich.	¶12.50@16.00
Grand Rapids, Mich.	12.00
Hartford, Conn.	*19.00
Jackson, Mich.	12.25
Lancaster, N. Y.	12.50
Madison, Wis.	a12.00
Michigan City, Ind.	11.00
Milwaukee, Wis.	*13.00
Minneapolis and St. Paul, Minn.	11.25
Minnesota Transfer	10.00
New Brighton, Minn.	10.00
Pontiac, Mich.	12.00@13.50
Portage, Wis.	15.00
Prairie du Chien, Wis.	18.00@22.50
Rochester, N. Y.	*19.75
Saginaw, Mich.	13.00
San Antonio, Texas	14.00
Sebewaing, Mich.	12.00
Syracuse, N. Y.	18.00@20.00*
Toronto, Canada	13.00@15.60†
Toronto, Canada	13.10
Wilkinson, Fla.	10.00@12.00

*Delivered on job. †Sales tax included.
‡Less 5%. ¶Dealers' price. (a) Less 1.00 E.O. M. 10 days.

Portland Cement

Prices per bag and per bbl, without bags net in carload lots.

	Per Bag	Per Bbl.
Albuquerque, N. M.	.....	3.47
Atlanta, Ga.	.....	2.35
Baltimore, Md.	.....	2.15
Birmingham, Ala.	.....	2.30
Boston, Mass.	.....	2.43
Buffalo, N. Y.	.....	2.28
Butte, Mont.	.90¼	3.61
Cedar Rapids, Iowa	.....	2.34‡
Charleston, S. C.	.....	2.35
Cheyenne, Wyo.	.82¼	3.31
Cincinnati, Ohio	.56¼	2.37‡
Cleveland, Ohio	.....	2.29‡
Chicago, Ill.	.....	2.10‡
Columbus, Ohio	.....	2.24
Dallas, Texas	.....	2.10
Davenport, Iowa	.....	2.29‡
Dayton, Ohio	.57	2.28
Denver, Colo.	.66¼	2.65
Detroit, Mich.	.....	1.95
Duluth, Minn.	.....	2.09‡
Houston, Texas	.....	2.60
Indianapolis, Ind.	.....	2.19
Jackson, Miss.	.....	2.50
Jacksonville, Fla.	.....	2.20
Jersey City, N. J.	.....	2.13
Kansas City, Mo.	.....	1.92
Los Angeles, Calif.	.61†	2.44†
Louisville, Ky.	.54¼	.....
Memphis, Tenn.	.....	2.60
Milwaukee, Wis.	.....	2.25‡
Minneapolis, Minn.	.....	2.32‡
Montreal, Que.	.....	1.36
New Orleans, La.	.....	2.20
New York, N. Y.	.....	2.05
Norfolk, Va.	.....	2.07
Oklahoma City, Okla.	.....	2.46
Omaha, Neb.	.....	2.36
Peoria, Ill.	.....	2.27‡
Philadelphia, Penn.	.....	2.21
Phoenix, Ariz.	.....	2.91
Pittsburgh, Penn.	.....	2.09‡
Portland, Colo.	.....	2.80
Portland, Ore.	.....	2.60
Reno, Nevada	.....	2.91
Richmond, Va.	.....	2.34
Salt Lake City, Utah	.70¼	2.81
San Francisco, Cal.	.....	2.31
Savannah, Ga.	.....	2.50
St. Louis, Mo.	.55	2.20
St. Paul, Minn.	.....	2.32‡
Seattle, Wash.	10c discount	2.50
Tampa, Fla.	.....	2.25
Toledo, Ohio	.....	2.20‡
Topeka, Kans.	.....	2.41
Tulsa, Okla.	.....	2.33
Wheeling, W. Va.	.....	2.07
Winston-Salem, N. C.	.....	2.78

NOTE—Add 40c per bbl. for bags.
†Delivered on job in any quantity, sacks extra.
‡Ten cents discount for cash, 15 days.

Mill prices f.o.b. in carload lots, without bags, to contractors.

	Per Bag	Per Bbl.
Buffington, Ind.	.....	1.85
Chattanooga, Tenn.	.....	2.45*
Concrete, Wash.	.....	2.35
Davenport, Calif.	.....	2.05
Detroit, Mich.	.....	2.15
Hannibal, Mo.	.....	1.85
Hudson, N. Y.	.....	1.95
Leeds, Ala.	.....	1.95
Mildred, Kans.	.....	2.35
Nazareth, Penn.	.....	1.95
Northampton, Penn.	.....	1.85
Richard City, Tenn.	.....	2.05
Steelton, Minn.	.....	1.90
Toledo, Ohio	.....	2.20
Universal, Penn.	.....	1.85

*Including sacks at 10c each.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	White Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	—Plaster Board— ⅜x32x 36". Wt. 1500 lb. Per M Sq. Ft.	½x32x 36". Wt. 1850 lb. Per M Sq. Ft.	Wallboard, ½x32 or 48". Lgths. 6'-10', 1850 lb. Per M Sq. Ft.
Arden, Nev. and Los Angeles, Calif.	3.00	8.00u	8.00u	10.70u	10.70u	.....	.....	.....	.....	11.70u	.....	.....	.....
Centerville, Iowa	3.00	10.00	15.00	10.00	10.00	10.50	13.50	.....	.....	13.50	.....	.....	.....
Detroit, Mich.	.....	.....	.....	.....	.....	.....	.....	m9.00@11.00o	.....	.....	.....	.....	.....
Delawanna, N. J.	.....	.....	.....	.....	.....	8.00	.....	8.25@9.40	.....	.....	.14½s	.15½s	40.00@41.00
Douglas, Ariz.	.....	.....	7.00	.....	.....	15.50d	18.50	.....	30.00	15.50	.....	.....	.....
Grand Rapids, Mich.	2.75	6.00	6.00	8.00	9.00	9.00	17.50	.....	24.55	20.00	.....	.....	.....
Gypsum, Ohio‡	3.00	4.00	6.00	8.00	9.00	9.00	19.00	7.00	27.00	20.00	.....	15.00	30.00
Los Angeles, Calif.	.....	.....	10.40k	11.10k	.....	.....	.....	.....	.....	.....	.....	.....	.....
Port Clinton, Ohio	3.00	4.00	6.00	10.00	9.00	9.00	21.00	7.00	30.15	20.00	.....	20.00	30.00
Portland, Colo.	.....	.....	.....	10.00	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Francisco, Cal.	.....	.....	14.00	14.40	15.40	.....	15.40	.....	.....	.....	.....	.....	.....
Seattle, Wash.	6.60	11.00	11.00	15.00	.....	16.00	.....	.....	.....	.....	.....	.....	.....
Sigurd, Utah	.....	.....	.....	.....	.....	.....	.....	.....	21.50	.....	.....	.....	.....
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00	.....	.....	.....	.....	20.00	25.00	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable).
*To 3.00; †to 11.00; ‖to 12.00; ‡prices per net ton, sacks extra; (a) to 25.00; (b) net; (c) gross; (d) hair fibre; (g) delivered; (h) delivered in six states; (i) delivered on job; (k) sacks 12c extra, rebated; (m) includes paper bags; (o) includes jute sacks; (r) including sacks at 15c; (s) per board; (t) to 16.50; (u) includes sacks; (v) F.O.B. N. Y. C. and dealers yard in mill locality.

Market Prices of Cement Products

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point

City of shipping point	Sizes 8x8x16	8x10x16	8x12x16
Camden, N. J.	17.00	.....	.....
Columbus, Ohio	.16@.18a	.....	.....
Detroit, Mich.	.16	.....	.18
Forest Park, Ill.	18.00*	23.00*	30.00*
Grand Rapids, Mich.	.15	.....	.....
Graettinger, Iowa	.18@.20	.....	.....
Indianapolis, Ind.	.13@.15†	.....	.....
Los Angeles, Calif.¶	5¾x3½x12—55.00	7¾x3½x12—65.00	
Oak Park, Ill.	.18@.21a	.....	.....
Olivia and Mankato, Minn.	9.50b	.....	.....
Somerset, Penn.	.20@.22	.....	.....
Tiskilwa, Ill.	.16@.18†	.....	.....
Yakima, Wash.	20.00*	.....	.....

*Price per 100 at plant. †Rock or panel face. (a) Face. ‡Delivered. ¶Price per 1000. (b) Per ton.

Cement Roofing Tile

Prices are net per sq. in carload lots, f.o.b. nearest shipping point unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.

Red	15.00
Green	18.00

Chicago, Ill.—per sq.	20.00

Cicero, Ill.—Hawthorne roofing tile, per sq.

	Chocolate Red and Orange	Yellow, Tan Green and Blue	Slate Gray
French and Spanish†	$11.50	$13.50	$12.75
Ridges (each)	.25	.35	.30
Hips	.25	.35	.30
Hip starters	.50	.60	.60
Hip terminals, 2-way	1.25	1.50	1.50
Hip terminals, 4-way	4.00	5.00	5.00
Mansard terminals	2.50	3.00	3.00
Gable finials	1.25	1.50	1.50
Gable starters	.25	.35	.30
Gable finishers	.25	.35	.30
*End bands	.25	.35	.30
*Eave closers	.06	.08	.06
*Ridge closers	.05	.06	.05

*Used only with Spanish tile.
†Price per square.

Houston, Texas.—Roofing Tile, per sq.	25.00
Indianapolis, Ind.—9x15-in.	Per sq.
Gray	10.00
Red	11.00
Green	13.00

Waco, Texas:	Per sq.
4x4	.60

Cement Building Tile

Cement City, Mich	Per 1000
5x8x12	55.00
Detroit, Mich.	Per 100
5x4x12	4.50
5x8x12	8.00
Longview, Wash.	Per 1000
4x6x12	52.00
4x8x12	64.00
Mt. Pleasant, N. Y.:	Per 1000
5x8x12	78.00
Grand Rapids, Mich.:	Per 1000
5x8x12	70.00
Houston, Texas:	
5x8x12 (Lightweight)	80.00
Pasadena, Calif. (Stone-Tile)	Per 100
3½x4x12	3.00
3½x6x12	4.50
3½x8x12	6.00
Tiskilwa, Ill.—8x8, per 100	15.00
Wildasin Spur, Los Angeles, Calif. (Stone-Tile)	Per 100
3½x6x12	50.00
3½x8x12	60.00
Prairie du Chien, Wis.	14.00 22.50@27.00
Yakima, Wash.—Building tile:	
5x8x12	.10

Cement Drain Tile

Graettinger, Iowa—5 to 36 in., per ton	8.00
Olivia and Mankato, Minn.—Cement drain tile, per ton	8.00
Tacoma, Wash.—Drain tile per ft.:	
3 in.	.04
4 in.	.05
6 in.	.07½
8 in.	.10
Waukesha, Wis.—Drain tile, per ton	9.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	30.00@35.00
Baltimore, Md. (Del. according to quantity)	15.50	22.00@50.00
Camden and Trenton, N. J.	17.00	
Ensley, Ala. ("Slagtex")	14.50	22.50@33.50
Eugene, Ore.	25.00	35.00@75.00
Friesland, Wis.	22.00	32.00
Longview, Wash.	18.00	25.00@75.00
Milwaukee, Wis.	14.00@15.00	30.00@75.00
Mt. Pleasant, N. Y.		14.00@23.00
Omaha, Neb.	18.00	30.00@40.00
Pasadena, Calif.	11.00	.....
Philadelphia, Penn.	15.00	20.00
Portland, Ore.	17.00	25.00@75.00
Prairie du Chien, Wis.	14.00	23.00@27.00
Rapid City, S. D.	18.00	25.00@40.00
Waco, Texas	16.50	32.50@125.00
Watertown, N. Y.	20.00	35.00
Wauwatosa, Wis.	14.00	21.00@42.00
Westmoreland Wharves, Penn.	15.00	20.00
Winnipeg, Man.	14.00	22.00
Yakima, Wash.	22.50	.....

†Gray. ‡Red.

Endorses Cement Block

THE extensive use of cement block, under the strict building code of Coral Gables, Miami, Fla., which requires that all structures be of masonry construction, is credited by J. P. Yoder, secretary of the Chamber of Commerce, with having minimized the effects of the recent hurricane in Coral Gables.

Mr. Yoder says: "Concrete and reinforced concrete construction of all Coral Gables public and large buildings as required by municipal building ordinance prevented any great damage to structures in this city.

"Coral Gables building code requires structures to be built of coral rock, hollow tile or cement block. The last mentioned material comprises 93% of materials used in 3500 buildings within the city limits.

"All such buildings withstood the terrific brunt of the hurricane without damage with the exception of where windows crashed in or roofs were splintered by flying missiles, which let in the rain."—*New York Times.*

Texas Crushed Stone Production Increases

DURING the year 1925 a total of 2,495,440 tons of limestone rock, valued at $1,898,185, was mined in Texas, according to statistics compiled by Dr. E. H. Sellards, director of the bureau of economic geology of the University of Texas. This rock was used for a variety of purposes, including building stone, curbing, rip-rap, road making, railroad ballast, agriculture and as a flux in smelting. The greater proportion went into road making and railroad ballast, more than 2,000,000 tons being used for these purposes. The production statistics were compiled from 20 Texas counties. Limestone for lime manufacture is not included in these figures. The use of limestone in agriculture at present in Texas is small, but in view of the abundance of limestone in the state it is likely to increase in the future.

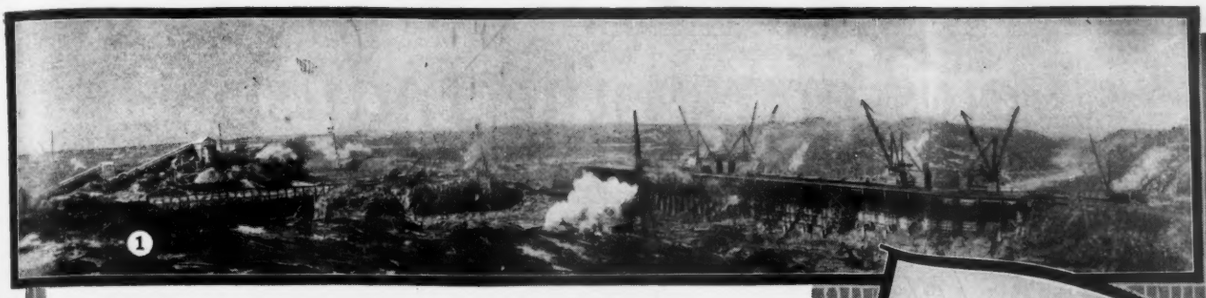
Of granite there was produced in the state in 1925 a total, for all purposes, of 7860 tons, valued at $178,375. Of this total more than half, 4450 tons, valued at $115,486, was for monumental stone. The granite is produced in the Llano and Mason districts.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted.

Culvert and Sewer	4 in.	6 in.	8 in.	10 in.	12 in.	15 in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Detroit, Mich.								15.00 per ton									
Graettinger, Iowa	.04½d	.05½	.08½	.12½	.17½	.....	.40	.50	.60	.70	.....	.....	.....	.....	.....	.....	.....
G'd Rapids, Mich. (b)	.....	.....	.....	.60	.72	1.00	1.28	.....	.....	1.92	2.32	3.00	4.00	5.00	6.00	.....	.....
Houston, Texas	.....	.19	.28	.43	.55½	.90	1.30	.....	†1.70	2.20	.....	.....	.....	.....	.....	.....	.....
Indianapolis, Ind. (a)	.....	.....	.....	.80	.90	1.10	1.30	.....	.....	1.70	.....	2.70	.....	.....	.....	.....	.....
Longview, Wash.							Sewer pipe 40% off list, culvert—list										
Mankato, Minn. (b)	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.50	1.75	2.50	3.25	4.25	.....	.....	.....
Newark, N. J.							6 in. to 24 in., $18.00 per ton										
Norfolk, Neb.	.....	.....	.....	.....	.90	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	.....	6.14	7.78
Olivia, Mankato, Minn.							12.00 per ton										
Paullina, Iowa‡	.....	.....	.....	.....	.....	.....	.....	2.25	.....	2.11	.....	2.75	3.58	.....	6.14	.....	7.78
Somerset, Penn.	.....	.....	.....	.....	1.08	1.25	1.65	.....	.....	2.50	.....	3.65	4.85	7.50	8.50	.....	.....
Tacoma, Wash.	.15	.18	.22	.30	.40	.60	.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tiskilwa, Ill. (rein.) (a)	.....	.....	.....	.65	.75	.85	1.10	1.60	.....	1.90	.....	2.25	3.40	.....	5.50	.....	.....
Wahoo, Neb. (b)	.....	.....	.....	.....	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	4.62	6.14	6.96	7.78
Waukesha, Wis.								12 in. to 60 in. 18.00 per ton									
Yakima, Wash.								$10.00 per ton									

*30-in. lengths up to 27-in. diam., 48-in. lengths after; (a) 24-in. lengths; (b) Reinforced; (c) Interlocking bar reinforced.
*21-in. diam. ‡Price per 2 ft. length. (d) 5 in. diam. [1]@1.08 [2]@1.25. [3]@1.65. [4]@2.50. [5]@3.85. [6]@5.00. [7]@7.50.



Some Notable Achievements of Engineering History

Large Dams, Irrigation Projects, etc.

In which Allis-Chalmers Engineering Service and Equipment have been Important Factors

1. Quebec Development Co., Isle Maligne Development. Complete rock crushing plant. Allis-Chalmers hydraulic turbines developing 540,000 H. P. are also being installed.
2. Roosevelt Dam, Elephant Butte, Arizona. Complete cement plant.
3. Ebro Dam, Barcelona, Spain. Crushing and cement plant.
4. Locks and Dam No. 17, Black Warrior River, Alabama, U. S. Government. Complete crushing plant.
5. Barberine Dam — Switzerland. Crushing, washing and screening plant.
6. Naval Dry Docks, Toulon, France. French Government. Crushing plant complete with motor drive.

7-8. Cheoah and Badin Dams and power plants, Yadkin River. Tallassee Power Co. In addition to the crushing plants used in construction, Allis-Chalmers hydro-electric units are installed in power plants.

9-10. Southern California Edison Co. Allis-Chalmers crushing equipment used in the construction of five large development projects as well as hydraulic and electrical machinery in several power plants.

11. Reservoir Dams, Government of Brazil. Rock crushing and cement grinding plants.

Arrow Rock Dam, near Boise, Idaho.
Panama Canal, Panama. Crushing plant at Colon.
Wilson Dam, Muscle Shoals, Tennessee River.
Lookout Shoals Development, near Catawba, N. C. Southern Power Co.
Tallulah Falls, Tallulah, Georgia. Georgia Railway and Power Co.
Goat Rock Development, Chattahoochee River, near Columbus, Ga. Columbus Power Co.

Let Allis-Chalmers Engineers Serve You.

ALLIS-CHALMERS

MILWAUKEE, WIS. U.S.A.

When writing advertisers, please mention ROCK PRODUCTS

News of All the Industry

Incorporations

Aurora Duntile Co., Aurora, Ill., $10,000. Manufacture and deal in cement products of all kinds. A. E. Norting, Blanche E. Watson, A. F. Anderson, Samuel J. Stephens. Corr.: Samuel J. Stephens, First National Bank Bldg., Aurora.

Aroostook Lime Co., Inc., Caribou, Me., 1000 shares of $10 par and 2000 shares of no par value. J. E. Hall, J. B. W. Hall and G. H. Sharp, all of Canton. To mine and quarry limestone and manufacture lime and its products.

Salem Lime and Stone Co., Salem, Ind., $15,000. Thomas M. Cavanaugh, Thomas E. Bellows, Edward Cavanaugh, Wilber W. Hottel and Luther C. Brown. To manufacture and sell lime and other stone.

Vernon Material Co., Chicago, Ill., 300 shares of no par value. E. Schroeder, F. P. Perkins and F. S. Salchenberger. Corr.: C. A. Phelps, 38 S. Dearborn St., Chicago. To operate sand and gravel pits.

Bluestone Block and Supply Co., Wilmington, Del., $250,000. W. A. McCoy, W. I. N. Rofland, W. Verdin. (Capital Trust Co. of Delaware.)

Purcell Cement Products and Building Co., Webb City, Mo., $165,000. E. D. Smith, P. C. Kelley, R. A. Mooneyham and others.

Hollywood Sand and Gravel Co., Inc., Los Angeles, Calif., $25,000. H. E. Bentley, R. L. Duncan and Verner Copeland.

Tex Rock Products Co., Farmington, Conn., $50,000. T. L. Sundgren, Ernest Plunker, M. T. Carlson and others.

Georgia Concrete Products Co., Savannah, Ga., $150,000. (Corp. Guarantee and Trust Co., Wilmington, Del.)

Castone Products Co., Cedar Rapids, Iowa, $50,000. W. F. Seavera, 302 Forest Drive, and others.

Acme Concrete Products Corp., Wilmington, Del., $400,000. (Delaware Corp. Charter Service, Inc.)

Magnestone Products Corp., Baltimore, Md., $50,000. R. A. Le Compte, Charles N. Mathews.

White Rock Quarry and Landscape Development Co., Clayton, Mo. Alfred De Benedetty.

Oregon City Concrete Co., Oregon City, Ore., $5,000. C. W. Myers and Fred P. Morey.

Los Angeles Art Stone and Staff Co., Moneta, Calif. Hurt Haas and Carrie A. Brown.

Kalamazoo Cement Products Co., Kalamazoo, Mich., $150,000.

Thunder Bay Limestone Co., Detroit, Mich., $50,000.

Quarries

Union Rock Co., Los Angeles, Calif., has removed its general offices to larger quarters at the Builders Exchange Building.

Ohio Blue Limestone Co., Marion, Ohio, has under construction the foundations for a new Edison roll crusher. The new crusher will be installed about 30 ft. below the quarry floor. A 36-in. conveyor belt 600 ft. long will carry material to the scalping screens over the crusher. The steel construction for the conveyor is being built by the Fairfield Engineering Co., Marion, Ohio.

Rock Products Co., San Francisco, Calif., has moved its office from 403 Hobart Building to 209 Utah Street.

Sand and Gravel

Tama Sand and Gravel Co., Tama, Iowa, has contracted to supply 70,000 tons of material to Tama and Benton counties for next year. A spur track will be built to the pit within a short time.

Chippewa Falls, Wis. A group of Eau Claire men are reported to have leased a 57-acre tract of sand and gravel adjacent to the Soo Line and Milwaukee railroad. A modern washing and screening plant will be erected on the deposit.

Tennessee Valley Sand and Gravel Co. has begun the dredging of sand and gravel at Buck Island, about 6 miles from Sheffield, Ala. Washed and screened material is shipped to a loading yard near Sheffield. Capt. G. S. Wilson is in charge of operations.

Lime

G. M. Bushey & Sons, Caveton, Penn., lime plant was severely damaged through recent fire of unknown origin. The damaged building, erected about a year ago, was used as a storehouse.

W. D. Mount, Fred W. McWane and others are organizing a company in Lynchburg, Va., to operate a modernly equipped lime plant in Botetourt county.

Gypsum

Northwest Gypsum Co., Lewistown, Mont., was host recently to a group of local Kiwanians. After a luncheon served by the company, the visitors were taken on a tour of inspection through the plant.

Cement

Lehigh Portland Cement Co. was host recently to a group of Rotarians from Boyertown, Penn. The visitors were guided about the Lehigh plant at Fogelsville and were then escorted to the General Trexler Game Preserve at Schnecksville.

Phoenix Portland Cement Corp., Birmingham, Ala., have moved their offices to 906-15 Alabama Power Building, Birmingham.

Cement Products

Lock Joint Pipe Co., Wilson Building, Dallas, Tex., is reported to have acquired a site on Capps Street, Fort Worth, Tex., on which a plant will be erected for manufacturing large-sized concrete pipe.

J. W. Dombert, formerly a partner in the Graham Cement Pipe Manufacturing Co. of Lodi, Calif., has purchased the interest of Mrs. Kittie Graham, widow of the founder of the business, and is now sole owner.

Concrete Pressure Pipe and Construction Co. has purchased a 2-acre site at Gilroy, Calif., and will build a $20,000 plant. George W. Eastman and Harry C. Sholten are the owners.

Hans Scheel, Jr., of the Tenino Sand and Gravel Co., Tenino, Wash., has engaged in the manufacture of concrete blocks.

William Myers is erecting a new cement products plant in Gladbrook, Iowa. A block machine and other equipment will be installed. A new product, a corncrib block, will be made, it is said, as well as the usual building and foundation blocks.

Miscellaneous Rock Products

Federal Fluorspar Co., Louisville, Ky., is to develop a 225-acre deposit near Mexico, Ky. Boilers, air compressors and grinding equipment at a total cost of about $50,000 will be installed.

Personals

J. G. Harrison has become sales manager of the Alton Barium Products Co., Alton, Ill.

Harlowe Hardinge, vice president and general manager of the Hardinge Co., York, Penn., has just returned from a three months' trip through the west and British Columbia.

R. C. Brower has recently been appointed general manager of the Timken Roller Bearing Service and Sales Co. Mr. Brower will make his headquarters in Canton, Ohio, at the main plant of the company, but will devote a great deal of his time to maintaining contact in the field.

E. Schmatolla, consulting engineer, announces his removal to Washington, D. C. His address is given as P. O. Box 1021.

Benjamin F. Affleck, president of the Universal Portland Cement Co., recently presided at a luncheon at the Palmer House, Chicago, tendered the finalists in the International oratory contest. Many prominent Chicagoans were among those present.

Bert Koenig of the Koch Gravel Co., Evansville, Ind., has been named on a committee to help conduct the annual Community Chest drive in that city in October, to raise money to meet the requirements of the chest for the coming year.

H. A. Pickett, sales manager of the David Mitchell Estate, Melbourne, Australia, was a visitor at the ROCK PRODUCTS office recently. Mr. Pickett, whose company operates the largest lime plant in Australia, is making an extensive visit to many lime plants in the United States in order to compare American practice and installations with those in use in Australia.

J. M. Allen has recently joined the factory organization of the Foote Bros. Gear and Machine Co., Chicago, as manager of production. Mr. Allen was formerly manager of production of the Mosler Safe Co., Hamilton, Ohio, for five years, and manager of production and traffic for the Goldsmith Metal Lath Co., Cincinnati, Ohio, for about one year, which position he left to accept his new position with the Foote Bros. Gear and Machine Co.

Manufacturers

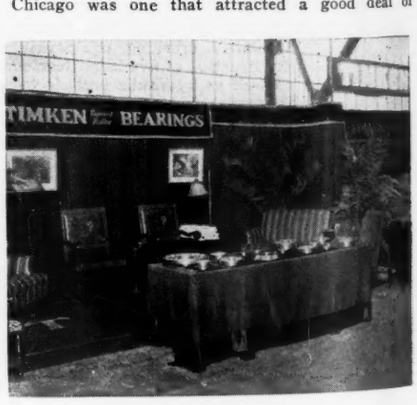
Columbus-McKinnon Chain Co. recently held a joint convention of the sales departments of the industrial chain division and the automotive departments at Tonawanda, N. Y. The entire sales policies of both divisions were reviewed, new merchandising ideas were presented and discussed under the chairmanship of Don S. Brisbin, general sales manager, and Warren J. Shay, sales manager of the automotive division. One of the features of the convention was the free and enthusiastic interchange of ideas between all present, officers of the company and salesmen alike.

Mundy Sales Corp., New York, N. Y., announces the appointment of Ole Olsen as exclusive distributor for them in Louisiana and F. W. Gartner for southern Texas.

Harnischfeger Corp., Milwaukee, Wis., announce a new complete line of excavators from ½- to 1¼-cu. yd. capacity, of unit cast steel construction.

American Steel and Wire Co., Chicago, Ill., have decided to enlarge the Birmingham, Ala., office to serve the trade in the South. J. J. Gilmore, heretofore in charge of the office, has been promoted to manager of sales.

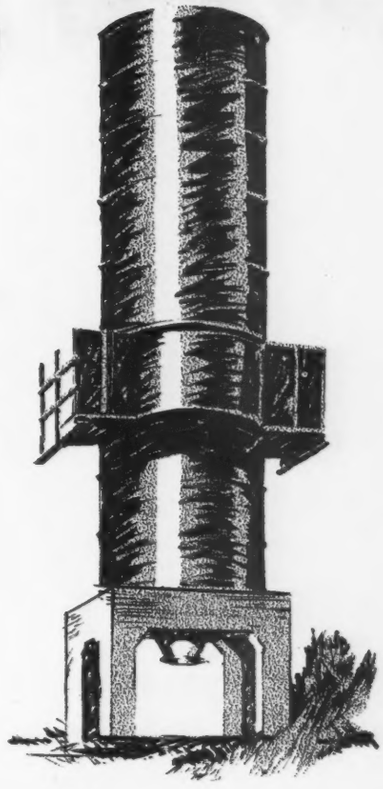
Timken Roller Bearing Co.'s exhibit at the National Machine Tool Exposition held recently at Chicago was one that attracted a good deal of attention. In one of two booths occupied there was arranged a unique display of Timken roller bearings and in the other a miniature model of the Timken plant at Canton, Ohio, which was complete in every detail.



Timken exhibit at Machine Tool Exposition

Stephens-Adamson Mfg. Co., Aurora, Ill., are to establish a Birmingham, Ala., office in the Martin Building with W. E. Harris in charge.

Accepted by the Industry



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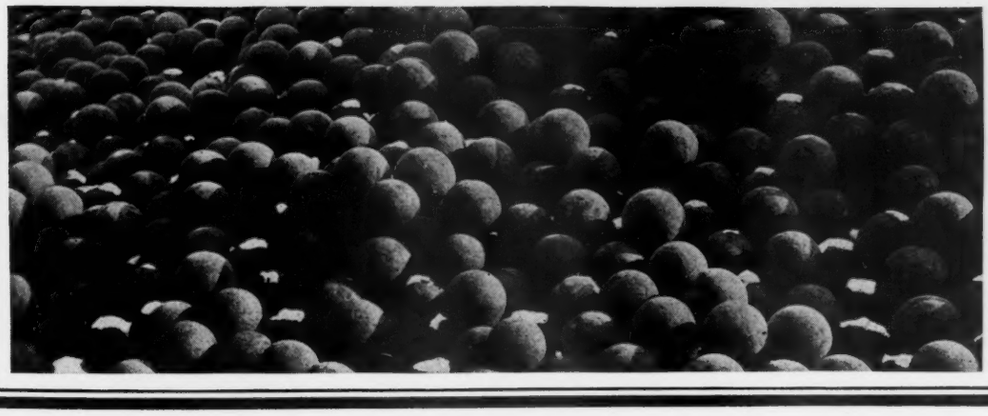

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Trade Literature

NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention ROCK PRODUCTS.

Lorain 75. Broadside illustrating uses and adaptability of this model, issued by THEW SHOVEL CO., Lorain, Ohio.

Beaumont Skip-Lift. Bulletin No. 79, describing and illustrating this device for elevating granular material such as sand, gravel, stone, coal, etc. Typical installations, capacity chart, data on design, etc. R. H. BEAUMONT CO., Philadelphia, Penn.

Handbook on Roller Bearing Applications. Bulletin No. 1560, containing data of value to engineers and draftsmen concerned with the designing or development of plant and production equipment. Covers in detail bearing application to general types of industrial equipment. Includes load and rating tables, formulas for determining bearing sizes for specific applications, suggestions for mounting—with drawings—photos of diversified Hyattized equipment, and construction details of all types of Hyatt roller bearings. HYATT ROLLER BEARING CO., Newark, N. J.

Lo-Hed Hoists. Catalog on the four classes of electric hoists, each containing 2 to 6 sizes, with various types of suspension and control, including bolt suspension, plain trolley, hand-geared trolley, motor trolley and two types of cab hoists and the choice of pendant cord control, push-button control and remote control. Capacities, ratings, dimensions and details of construction, illustrations, etc. AMERICAN ENGINEERING CO., Philadelphia, Penn.

Cyclone Picker. Catalog describing and illustrating Cyclone type picker for hair, cotton, etc., manufactured by WEBSTER MFG. CO., Chicago, Ill.

Insulating Brick. Bulletin No. 103, describing four types of Sil-O-Cel; insulating brick—standard for temperatures up to 1600 deg. F., C-22, from 1600 to 2000 deg. F., super-brick, for use up to 2500 deg. F., and rotary kiln brick, a special calcined form for rotary cement and lime kilns. Includes description and illustrations of methods used in bonding walls where insulation is used. CELITE PRODUCTS CO., Los Angeles, Calif.

Sullivan Portable Air Compressors. Bulletin No. 83-D, describing Sullivan portable air compressors of three distinct types: "WK-312" and "WK-314," gasoline-engine-driven; "WK-34," belt driven from a tractor, and "WK-32," driven by belt from an electric motor. These types include a capacity range from 110 to 320 cu. ft. to suit varying conditions, with mountings. SULLIVAN MACHINERY CO., Chicago.

Industrial Chain Drives. Booklet listing sizes, types and prices on standardized chain drives ready for immediate delivery, issued by BOSTON GEAR WORKS SALES CO., Norfolk Downs, Mass.

Nickel Cast Iron. Bulletin No. 201, containing data on the properties and applications of nickel and nickel-chromium cast iron. THE INTERNATIONAL NICKEL CO., New York.

Poole Flexible Coupling. Bulletin 108, describing Poole all-metal flexible coupling and showing its construction in detail, with table of data for use in determining sizes. POOLE ENGINEERING AND MACHINE CO., Baltimore, Md.

Kirk and Blum Blower Systems. Informative and useful booklet containing interesting information on blower engineering. Illustrations and descriptions of recent blower installations and new developments in blower equipment. THE KIRK AND BLUM MFG. CO., Cincinnati, O.

3-Speed Transmission Hoist. Bulletin on the new patented 3-speed transmission hoists of gasoline and electric types. Capacities, construction details, specifications, etc. THE MUNDY SALES CORP., New York, N. Y.

Keystone Safety Lubricator; Questions Answered and Typical Installations Illustrated. A thorough discussion of the lubricator, its purpose, method of operation, relation to safety, adaptability, etc. Various types of installation are discussed and illustrated together with the accessories that have been designed to reduce the time of lubrication attention. KEYSTONE LUBRICATING CO., Philadelphia, Pa.

Suction Torches. Bulletin on the Hauck Venturi suction torch and equipment containing details of capacity, sizes, and general information. HAUCK MFG. CO., Brooklyn, N. Y.

G. E. Bulletins. GEA-38 on the direct current crane and hoist motors, type CO-1820, and **GE-71A** on the wound rotor induction motors—"900 Series"—types MT (3 phase) and MQ (2 phase). GENERAL ELECTRIC CO., Schenectady, N. Y.

C-E Unit System for Burning Pulverized Fuel. Catalog U-2 illustrating and describing unit system designed for burning pulverized fuel. Diagram of installations of different capacities and details on equipment and construction. Data on design, uses and capacities, etc. COMBUSTION ENGINEERING CORP., New York.

Waterproofing Concrete, Stucco, etc. Bulletin on the use of specially reground portland cement for use in waterproofing of concrete, plaster, stucco, etc. ADVANCE WATERPROOF CEMENT CO., Chicago, Ill.

The Operator's Stabilizer. First issue of a new and interesting house organ published by the LINCOLN ELECTRIC CO., Cleveland, Ohio.

Electric Flow Meter. Broadside on improvements made in models of flow meters manufactured by the BROWN INSTRUMENT CO., Philadelphia, Pa.

Merco-Nordstrom Valves. Catalog No. 5 illustrating and describing plug-valves for different purposes. Specifications, design, capacities, etc., and details on proper lubricants. MERCO-NORDSTROM VALVE CO., San Francisco, Calif.

Automatic Welding. Bulletin describing and illustrating methods and apparatus used in automatic air welding with "Stable Arc" automatics. LINCOLN ELECTRIC CO., Cleveland, Ohio.

Centrifugal Pump Installation. Data sheets Nos. 15 and 16 outlining plans for installing centrifugal pumps to be used in connection with automatic pressure-tank system. Supplement to data book No. 2058. DAYTON-DOWD CO., Quincy, Ill.

Drag Line Buckets. Bulletin No. 666 on new dragline buckets of ¼ cu. yd. and up manufactured by the HAYWARD CO., New York, N. Y.

Lubrication Instructions. Revised edition of a booklet specially prepared on the subject of proper lubrication of medium speed industrial engines by the CLIMAX ENGINEERING CO., Clinton, Iowa.

Recent Developments in the Application of Tapered Roller Bearings in Machine Tools. Paper presented by S. M. Weckstein, industrial equipment engineer, Timken Roller Bearing Co., Canton, Ohio, at the Machine Tool Section meeting of the A. S. M. E. held at New Haven. Reprints available on application to TIMKEN ROLLER BEARING CO., Canton, Ohio.

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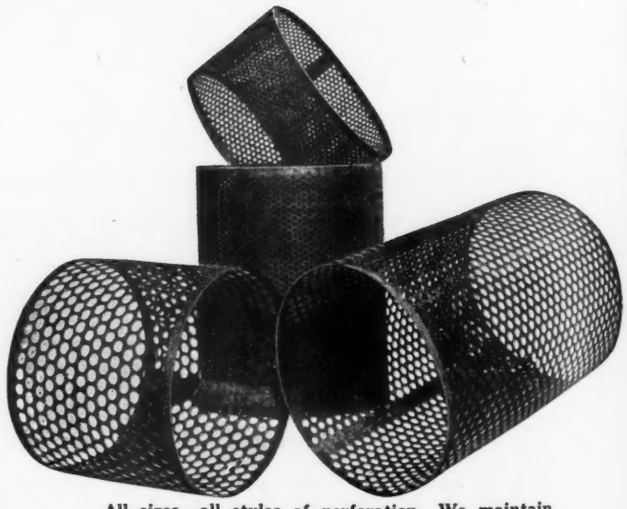

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